THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXVIII. No. 1738.] LONDON, SEPTEMBER 1, 1896. [48TH YEAR. PRICE 6d.

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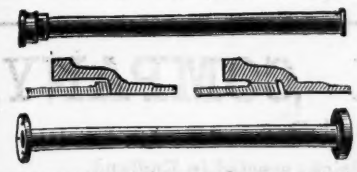

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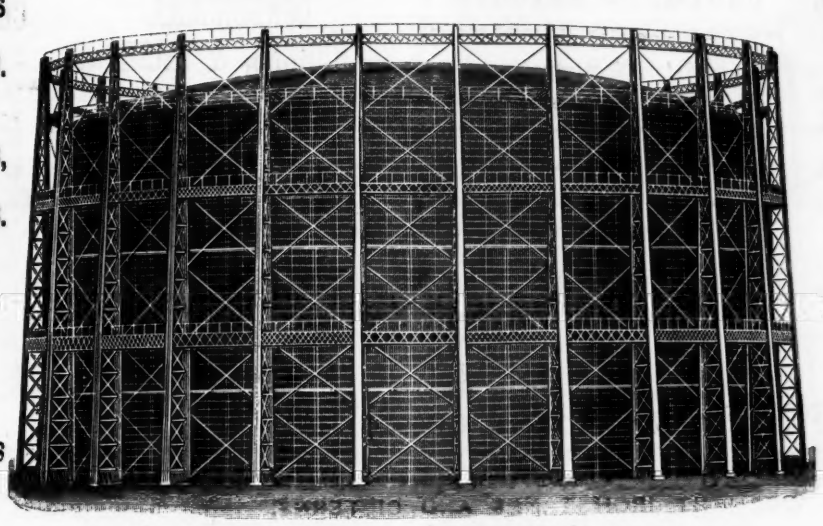

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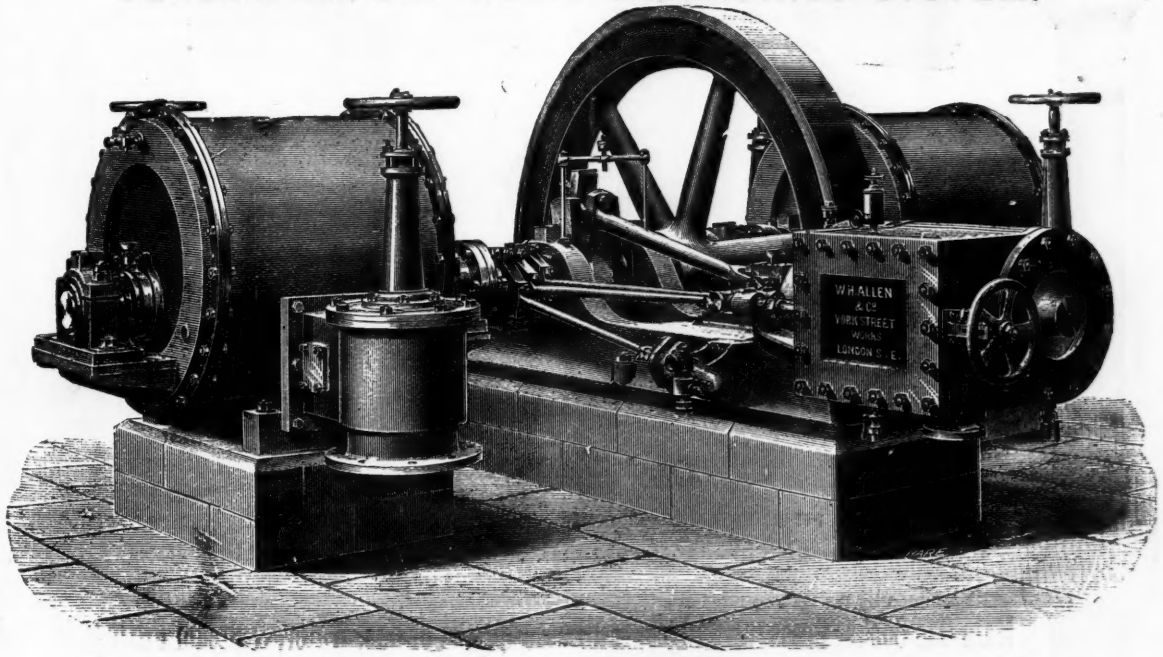

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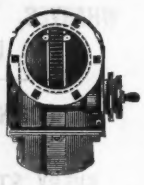

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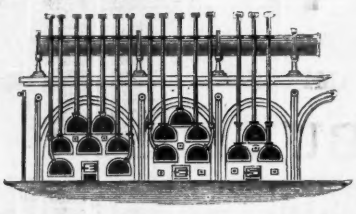

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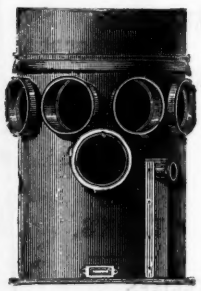

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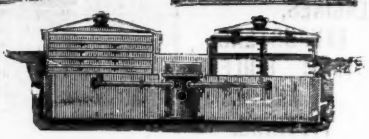

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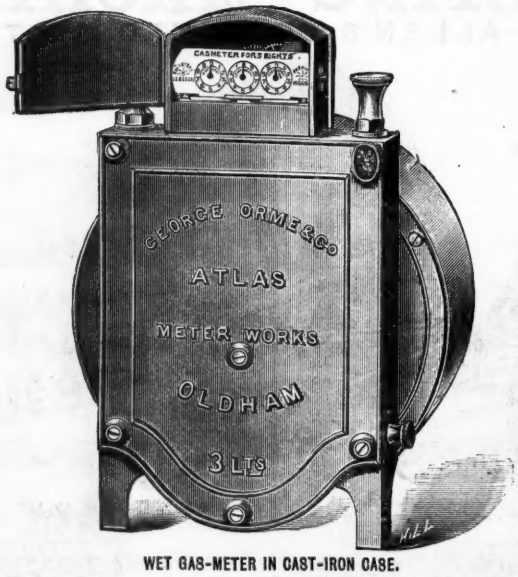

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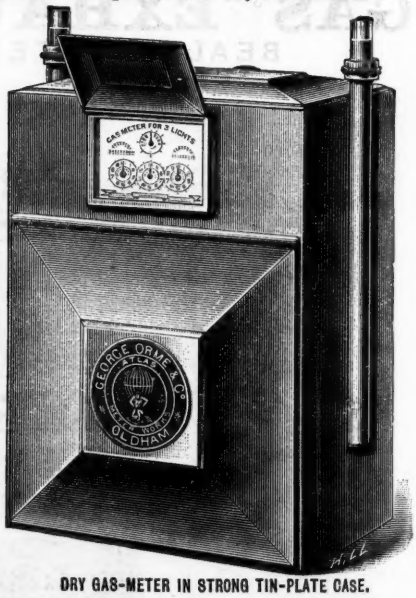

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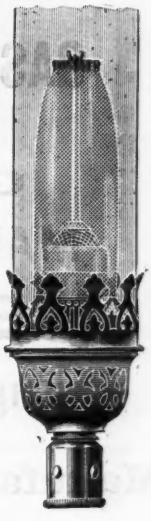

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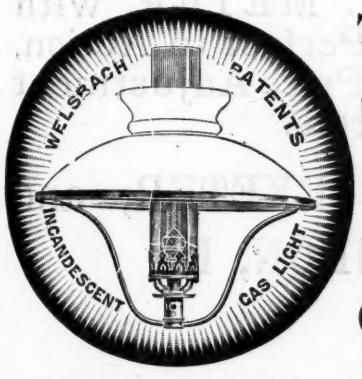

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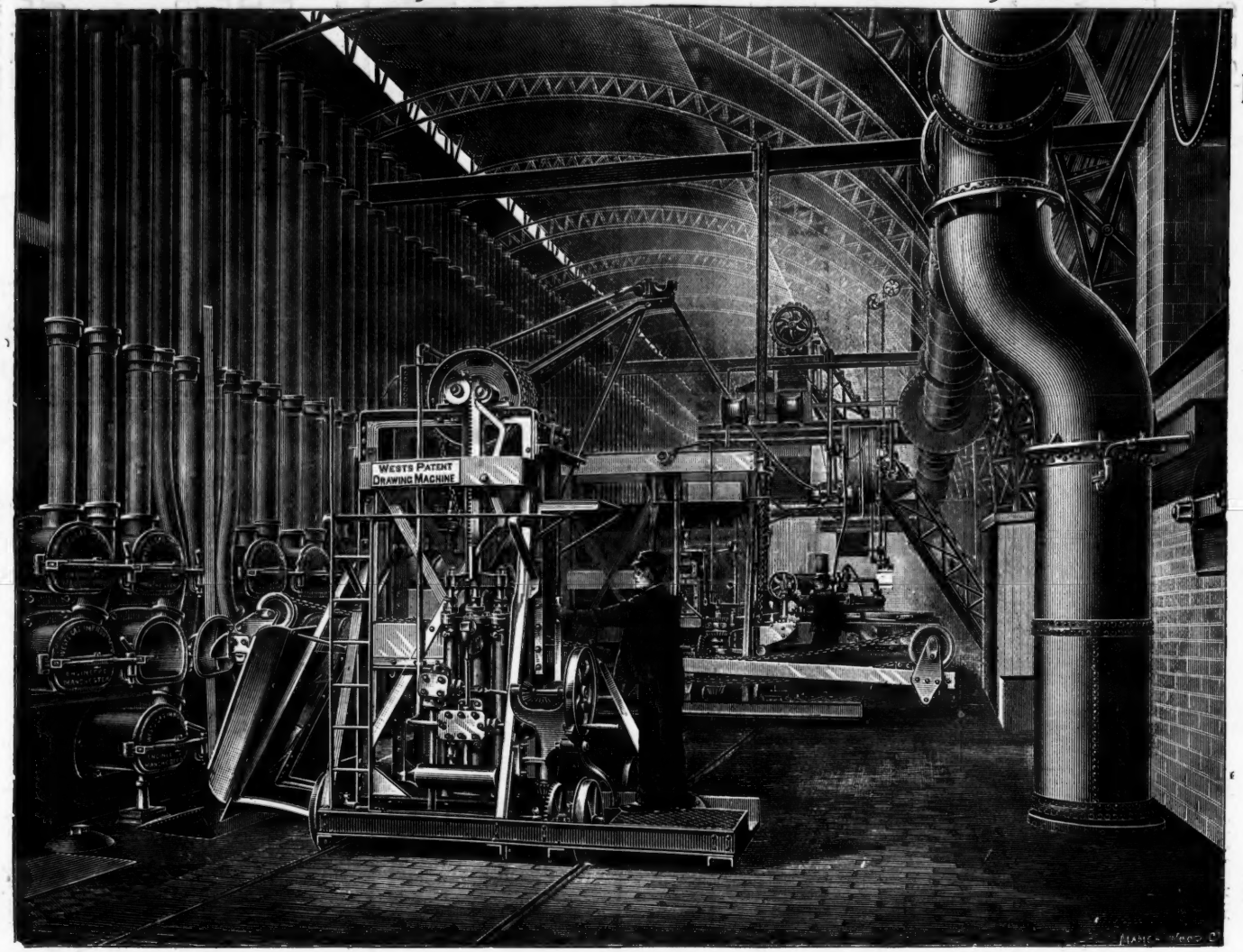

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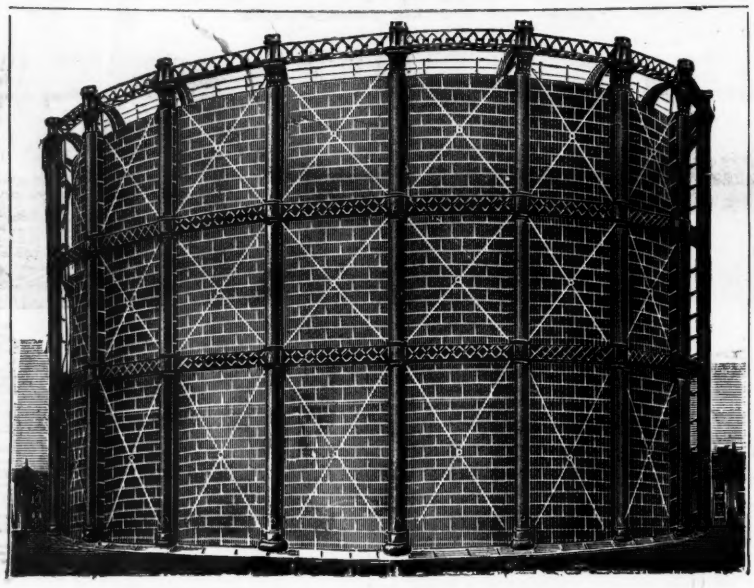

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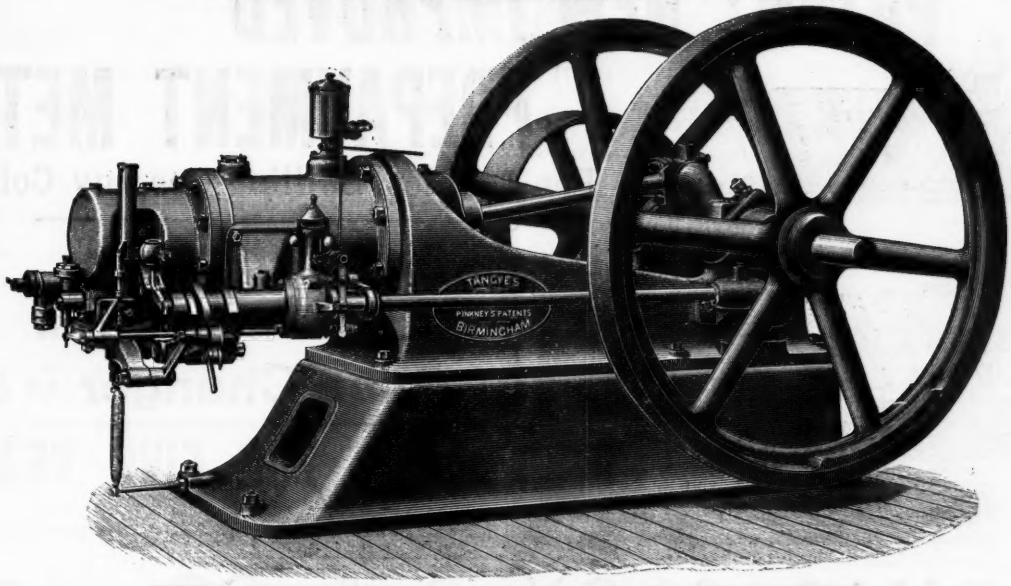

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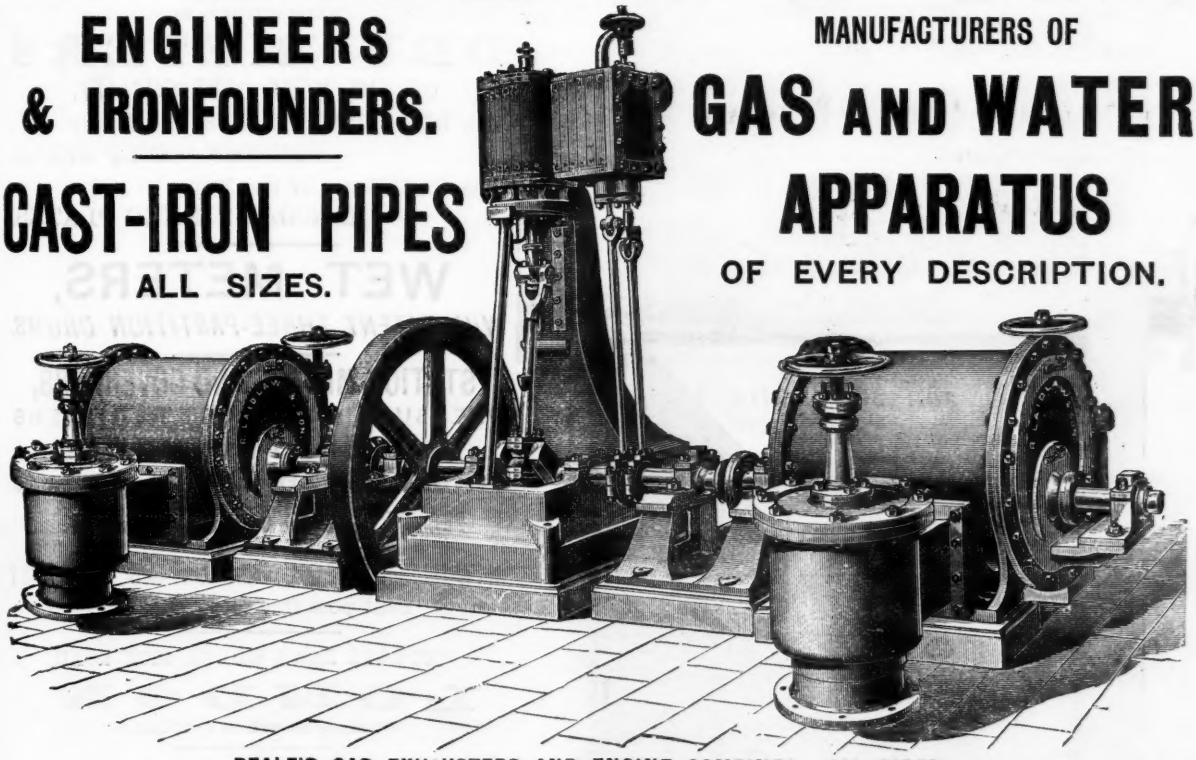

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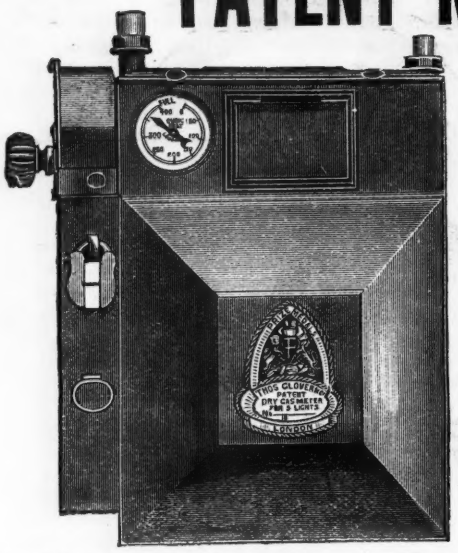

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TO CORRESPONDENTS.

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WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.

EDITORIAL NOTES.

Street Lights and Lighting.

FROM time to time one or other of our technical contemporaries appears to awake to a transient perception of the importance and interest of some of the topics which we are in the habit of discussing in these columns; and then our regular readers would be amused at the naivety with which they propound and chat about these matters, as if they had never been mooted before. Thus, in its current issue, the "Builder" has an article devoted to the subject of street lighting, in which this by no means (to us) unfamiliar problem is treated with much gravity in a style which is mixed professional and amateurish. The writer, of course, approaches the subject from the side of electric lighting. He has the idea that gas lighting is occasionally—or has been in bygone ages—used for this purpose; but naturally he does not regard this method of lighting streets as worthy of the serious attention of a scientific person. He considers that street lighting deserves more study as a technical problem than it generally receives. This is quite true; the consequence of this neglect of the subject being that electricians have in recent times been able to bewilder members of local authorities with their talk about tens of thousands of candle power, and so forth. "The public has a hazy notion that, by using the electric "arc, far more light is obtained than when gas-lamps are "used, at no extra cost." Quite true; but who gave currency to this unfortunate delusion? Again, when people find out, through the conclusive evidence of heightened rates, that street lighting by electricity is more expensive than gas, they begin to think their earlier notion must have been a mistaken one—"forgetting that in this case the extra cost "is due to the far higher standard of lighting demanded." True again; but the learned writer forgets, after the manner of his kind, the curious *lapsus* in his explanation. He begins by acknowledging that the expectation of the public is excited by the "hazy notion" of getting far more light from electricity than from gas at the same cost; and he goes on to upbraid the same public for grumbling at a higher lighting bill, seeing how much more light they get for the extra money. This is the very same logical and financial fault that has troubled so many communities.

The writer of the "Builder" article proceeds to discuss, very acceptably, the question of whether in street lighting the horizontal illumination (the lighting, that is, of the ground surfaces) or the vertical illumination (the lighting of the various objects standing or moving upon the ground surfaces) is the more important. He states that, in the early days of arc lighting, the securing of a uniform horizontal illumination was what was aimed at, and that this was approximately obtained by placing powerful arc lamps at great heights from the ground. The direction in which the ordinary arc lamp, without glass, gives out its light, seemed to favour this method of distributing the illuminating effect. But, as is known, the experiment resulted everywhere in disastrous failure. Incandescent gas-burners, as the writer truly observes, give out their light in quite a different way to arc lamps. Most of their lighting effect, unshaded, being in the horizontal plane, the vertical illumination produced by these burners is very good when they are not placed too high up. We are grateful for the admission that "the perspective effect produced "by a row of Welsbach lamps is distinctly good, as they "are visible a long way off." Anyone who has noticed the appearance of a straight wide avenue, with or without ornamental trees, lit in this style, will fully agree with this observation. Strangely enough, the writer goes on to aver that the invention of "stronger mantles" must be a preliminary to the general adoption of incandescent gas-lamps for street lighting. "After three months' experience "at Leamington, they were discontinued, owing to the "number of the mantles broken by the vibrations caused "by the traffic." Where has this writer been living of late, and where have his eyes been, that he can pose this solitary experience—which may or may not be verifiable—as summing up the case against the use of incandescent gas-lamps for street lighting.

What he has heard from Leamington on the subject, at any rate, confirms the writer in the "Builder" in the opinion, which he in all probability held before, that the electric arc lamp is the street-lamp of the future. Again, the electrician prophesies! He pauses in his vaticinations, however, to emit the general rule, which is fairly

admissible for any method of street lighting, that when the ground lighting, or horizontal illumination, is kept above a certain minimum, the vertical lighting of objects on the ground is certain to be satisfactory. In discussing the proper position of street-lamps, the writer admits that placing them in zigzag on opposite sides of the street is both economical and effective, if the streets are narrow. Where the thoroughfare is broad, the side lamps should be opposite one another, with refuge-lamps at the crossings. The writer rather inclines to the use of span wires across the streets, although he admits that the daylight effect is unsightly. There is something in the argument that the span wires enable the lamp-posts to be got rid of from the pavements; but, at least for main thoroughfares, the objection to wires crossing roadways at a height less than that of the buildings along the sides is very serious.

Again, it is possible to agree with the writer in the degree of importance he assigns to the proper choice of diffusing glasses and globes for high-power artificial lights of any kind. He strongly recommends the use of globes of the Fréduréau and Holophane patterns—which, be it observed, were described by us long ago. Upon this point, he says: "There is no doubt that brilliant sources of light, and "beautiful globes, are desired by the public; and if "globes like the Holophane prove a commercial success, "a great impetus will be given to the lighting of our "streets. Rows of dingy lamp-posts at present obstructing "the pavements of the main streets of many towns could "be removed, and the streets effectively lighted by a few "arc lamps in elegant globes, judiciously placed, without "unduly burdening the ratepayers." The ideas in this passage are slightly mixed. We venture to believe that whatever improved globes can effect to heighten the duty of street-lamps will be as much in favour of gas as of any other illuminant; and we flatly discredit the insinuation that, where electric lamps already burden the ratepayer, they can be rendered less onerous by enclosing them in any kind of globe that ever was or ever will be invented.

Labour Topics of the Week.

The new Labour Associations have usurped the place formerly held by the sea-serpent among the resources of the newspaper press. There is no fear of the "dead season" coming upon us too heavily while such energetic individuals as Mr. Alderman Ben Tillett continue to stir up the Home and Continental Port Authorities, while Mr. Sam Woods has the Trade Union Congress to arrange for, and the Amalgamated Engineers and Boiler Makers refuse to prefigure the mutual attitude of the lion and the lamb in the Millennium. The latest intelligence from the Chiswick yard is that Mr. John Burns has suggested an amalgamation of the contending trade societies as the only way out of the difficulty that divides them. The suggestion is not a bad one, in the Trade Union interest; and, of course, that of the employers is not to be taken into consideration for an instant. Mr. Pickard and his coal miners are for the moment in the background of the somewhat stormy picture exhibited by the industrial organizations of the country. But they may shortly come to the front again, as rumours of the intended formation of a coal ring are once more being circulated; and the Federation is certain to have a hand in any arrangement calculated to keep up the price of coal. According to a communication published in last Thursday's "Times," the arrangement in question is to be merely an amalgamation of the leading London firms interested in the carriage, lighterage, and delivery of coal, and (of course) is very far removed from the nature of anything like a "ring" with the object of forcing up prices. From this statement, it would appear that the proposed arrangement will apply to the retail house coal trade only, in which it is notorious that great economies might be effected.

The most interesting of the Labour questions of the hour is once more an engineering dispute on the Clyde. Here matters have never really settled down since the last trouble. Although the Amalgamated Society of Engineers came out of this trial rather better than was to have been expected, at any rate as regards membership—for many men joined the Society at the time for the sake of getting strike pay—the heavy levies which all the members were forthwith called upon to contribute created much discontent among the rank and file. This disaffection was met by the local leaders by starting a policy of aggression against non-society men, with the familiar object of demonstrating that there was no livelihood to be made in the trade outside the ranks of the Union. As usual, this movement was carried out piecemeal, by means of an apparently insignificant series of isolated shop strikes. Matters came to a climax, however, when the local Union leaders ordered a strike at certain works which were not believed to be financially strong, because the firm refused to discharge a non-unionist at their dictation. The firm appealed to the associated employers, who realized the gravity of the situation and promised help. They at the same time communicated the state of affairs to the head-quarters of the Amalgamated Society of Engineers in London. The authorities of the latter were unwilling to countenance a strike on the bald point of freedom of labour; and they at once sent orders to Glasgow for the men to return to work, with the intimation that if they refused they would not be supported out of the Union funds. Here is a very curious illustration of the supposed advantage to employers of having to deal with a powerful trade organization, which Trade Union apologists so frequently dilate upon. The Amalgamated Engineers ought to be strong enough to secure the obedience of their branch officers; yet, as a matter of fact, the central executive are powerless to put a stop to the trouble on the Clyde. Their refusal of strike pay has had no effect, because the rebellious branch officers have organized voluntary local levies, which have thus far been sufficient to keep the strike going. In these circumstances, the associated employers have been constrained to take the only efficacious course of threatening to stop the stream of insurrectionary supplies at its source. Accordingly, it is announced that "notice will be given on "Saturday, Sept. 12, and on each of the three succeeding "Saturdays, of 25 per cent. of the members of the "Amalgamated Society of Engineers presently employed "throughout the shops of the federated employers." It remains to be seen whether this threat will bring the recalcitrant Trade Unionists to their senses; but, in any event, the incident is a severe shock to the idea of the utility of a "powerful" trade society.

German Rebellion against an American Tyranny.

It has often been observed that the theoretical and formal arrangements under which the world exists, fail to represent all the conditions that practically govern its workings. The poet had a glimmering perception of this truth when he made the famous declaration about the impotence of Kings and laws to cause or cure the gravest and the greater number of the ills that flesh is heir to. The Apostle Paul was much before the poet, however; and probably the Egyptian papyri and the Hittite inscriptions will some day be interpreted as proving how long ago it was understood that the things that really matter in the world are not those that legislators and magistrates are usually concerned with. Take the commonly taught elements of contemporary political geography. The child at school is instructed that there are certain "Great Powers" which dominate the world; and when he becomes a man, he goes on believing the same—being encouraged thereto by the newspapers. Occasionally, however, one gets a faint impression that the Great Powers of the world are not various national governments commonly catalogued under this heading, and also that the lesser powers are in point of fact something other than those of which the school-books treat. An illustration in point is given by a communication from Berlin which recently appeared in "The Times," stating that the German Government are engaged in "carefully considering the question of regu-"lating the trade in petroleum, or, in other words, of "finding means to prevent the American corporation "known as the Standard Oil Company from acquiring "complete control of the German market." This passage reminds the reader that if Germany is one of the Great Powers of the world, the Standard Oil Company is another, and quite powerful enough to be worthy of the antagonism or alliance, as the case may be, of any Government. The report goes on to recount how rather more than two years ago an attempt was made by the Standard Oil Company to conclude a contract for the partition of the world with the Syndicate of Russian oil producers. According to the arrangement then proposed, the Russian Syndicate would supply all the petroleum needed by Eastern Europe, Asia, Australasia, and the East Coast of Africa; while the Standard Oil Company would have the monopoly of the trade in Western Europe, America, and the West Coast

of Africa. Before accepting the contract, however, the Russian Syndicate stipulated that the Standard Oil Company must make their monopoly good over the whole of Western Europe, by buying up, crushing, or in some way destroying all independent opposition. This course has been followed with some success in all the countries of Western Europe excepting Germany; and here the Standard Oil Company have waged a bitter and unscrupulous war of prices for two years past against all independent merchants. The final obstacle to the partition of the world is now stated to have been overcome; for the American monopolists have succeeded in destroying the greater part of the independent German opposition; and the German Imperial Government are now trying to place some check that shall prove effective in the process of starving the German trade for the benefit of the American tyranny. It remains to be seen what form this check is to take; but, in any event, the record is a striking one. Happily, the gas industry of Europe is not yet at the mercy of the Standard Oil Company.

WATER AND SANITARY AFFAIRS.

A LETTER from Mr. George Livesey in "The Times" of Thursday last discusses some important questions relative to the supply of water. As a remedy against waste, the leading organ and some of its correspondents, including Major Rasch, have advocated a supply by meter—a minimum charge being made in every case sufficient to pay for a proper amount of water, so as to guard against undue parsimony. Any consumption in excess of the minimum would be met by an extra charge *pro ratâ*. Mr. Livesey says that the supply of water by meter is "unquestionably "the best, if not the only, remedy against waste." In taking this stand, he has to meet the objection that as the water-rate, in the case of small house property, is almost invariably paid by the landlord, the supply by meter would not act as a corrective to the reckless disposition of the tenant. In reply, Mr. Livesey suggests that "the "penny-in-the-slot system could as easily and as success-"fully be applied to water as it has been to gas." The tenant would then pay directly for his water, and it would be the duty of the landlord to make a corresponding reduction in the rent. We must confess to some misgiving as to whether the tenant would be lucky enough to get his pennies back again. Neither are we quite sure that the Water Company would get their due. Among the water consumers, especially at the East-end, there is a roving class who would be hard to catch, so as to bring them to a proper reckoning. But the "penny-in-"the-slot" system, if it could be made to work, would do away with the necessity for the minimum charge, which Mr. Livesey states was tried in the case of the gas supply when meters were first introduced, but was afterwards abolished, to the satisfaction both of the consumer and the Company. Concerning the minimum charge, it is not very evident how it is to be fixed in a diversified population like that of London. Is it to be according to the rent of the premises, or the number of the occupiers? On the whole, we greatly doubt whether a supply of water by meterwould be found practicable in the more densely populated parts of the Metropolis. Gas is not taken by everybody, but water is universally consumed—a circumstance which puts one supply on a very different footing from the other. The cost of furnishing a meter to every house will represent an enormous sum in the aggregate, greater in the particular case than that which has been represented as a difficulty in supplying the present lack of house cisterns in East London. Moreover, if the "penny-in-the-slot" system were adopted, every separate tenant in a house would require his own meter. A charge levied by the Company for meter-hire would not be popular, and would introduce a further complication.

We go a long way in agreement with Mr. Livesey when he expresses his surprise that the London Water Companies have not followed the example of the Gas Companies by amalgamating. The change would be economical, and would greatly improve the engineering conditions of the supply. A consolidation of the water districts, as we have recently pointed out, would have anticipated the demand for placing the entire water supply of the Metropolis under one authority. Mr. Livesey thinks that "one huge concern would be a mistake." If so, it must simply be on the ground that a monopoly would be established, and the "competition of comparison" would be destroyed. Here, again, there is a difference between water and gas. It was always the idea of the late Sir Francis Bolton that the water supply of London should be arranged in zones of equal pressure. There is not so great a need for this in the case of the gas supply. Still more important is the fact that by having one set of distributing works for all London and the outskirts, there would be the less risk of failure in the water supply for one particular part. As for the "competition of com-"parison"—alluding, of course, especially to price, though not to that exclusively—there is plenty of such competition now, but no actual benefit to anybody is supposed to arise from it. Mr. Livesey suggests that two Companies on the north and one on the south of the Thames "would "surely be better than the present eight Companies." Doubtless such an arrangement would be an improvement. But we also believe, for physical reasons, that one Company north of the river, as on the south, would be better still. Mr. Livesey seems guided throughout by his gas experience; and so far he has much to rely upon. The parallel is preserved by a reference to the sliding-scale. He argues that if water were supplied by meter, an increase of dividend might be allowed according to a reduction in the charge per 1000 gallons. The idea is ingenious; and theoretically it is not without merit. In fact, the Companies might wish for it. But then we must have the meter supply; and that seems a long way off. Mr. Livesey could have gone a step further; but he has judiciously paused, or he might have assimilated the supply of water to that of gas by suggesting that the Company could be subjected to penalties, according to the number of microbes in a cubic centimetre of the water, or in proportion to the grains of organic carbon and nitrogen per gallon.

While "The Times" continues to bring forward incontrovertible facts and logical arguments on the subject of the water supply, in reference to East London and the Metropolis generally, the "Daily Chronicle" is becoming increasingly frantic in its attacks on the East London Company and on the entire system of the Metropolitan Water Supply. We were startled last Wednesday, on looking into the columns of our contemporary, by the appearance of a series of head-lines, in large type, concerning "Our "Chartered Company," "The Case for the Defence," and "The Plot against East London." We thought of Dr. Jameson and the Transvaal, and feared some fresh African trouble. But we found that the column-and-a-half which followed was simply a fresh cavalry charge on the so-called "water lords." The tactics consisted in disputing the real facts, and trotting out the most extraordinary figments; the same plan being adopted in a leading article intended to give some increased force to the diatribe indited by "Our Special Commissioner." "The Times" is contented with a "Special Correspondent;" but the "Chronicle" issues a "Commission," which appears to be thoroughly understood and fulfilled. In the editorial, it is asserted that had the East London Company ten years ago "exercised the most elementary prudence and foresight they would have been ready for the recent drought. the Company are to be blamed for not seeing ten years into the future, what is to be said of the County Council which could not see three, or even two, years ahead? When the East London Water Bill came on for second reading in April, 1894, Mr. Stuart, acting on behalf of the County Council, moved that the Bill be rejected, and contended there was abundant proof that the East London Company "had not only adequate water for the "present and for many years to come, but were able to "supply it subject to the conditions proposed to be "imposed upon it by the Royal Commission." This authoritative gentleman emphatically denied that there was any danger of a deficiency in the supply, supposing the Company failed to obtain additional powers. Yet the "Chronicle" now blames the Company for not "keeping "pace with the growth of the new East London," and for not "laying down new reservoirs" some years ago. We may remind the "Chronicle" how every attempt on the part of a Metropolitan Water Company to obtain parliamentary powers to raise additional capital for the construction of new works has been resented as part of a design to give a fictitious value to the undertaking. Now the cry is raised—as by Sir Albert Rollit in a letter to the Hackney

Vestry—that the East London Company have yielded to a temptation "to choose between dividends and disease." The East London Company have yielded to no such temptation; for, in order to prevent a dearth of water, they have proposed to enlarge their capital account, and thereby either reduce their dividends or prevent their increase. Now we are told, in the columns of "London," that "it is intended to organize a series of indignation "meetings in the East-end districts, and bring public "opinion to bear upon the defaulting Company." If "indignation" meetings had been held in 1893, to bring public opinion to bear on the County Council, some good might have ensued. But we are at a loss to learn what purpose the contemplated indignation is to serve, when directed against a Company who would have provided an adequate supply of water had they been permitted to do so.

OBITUARY.

We regret to record the death, last Tuesday, from typhoid fever, of Mr. JOHN L. MITTON, the Engineer and Secretary of the Longwood Gas Company. Mr. Mitton was formerly at Kidsgrove; but in 1891 he was selected to succeed Mr. Neill Meiklejohn in the position at Longwood which he held at the time of his death. The funeral took place last Friday.

PERSONAL.

Mr. A. E. SAVILLE, of Darwen, has been appointed Manager of the Colwyn Bay Gas-Works.

Mr. J. MILES, the Secretary of the Lewes Water Company, has received an addition of £30 per annum to his salary.

Mr. E. THOMPSON, has been appointed Secretary and Manager of the Grange and Cartmel District Gas and Water Company.

Mr. J. RANDALL, the Secretary of the Tottenham and Edmonton Gas Company, has had his salary raised by £50 per annum as from July 1 last. From small beginnings, Mr. Randall has seen the concern grow to its present important dimensions; and during the past few years the responsibilities of his office have increased considerably—in large measure through the spread of the automatic meter system. The number of these meters in the district is fast mounting up to that of the ordinary meters; the former on June 30 last standing at 3387, and the latter at 5764.

The Autumn Meeting of the Institution of Gas Engineers.—In the "JOURNAL" a few weeks ago, we gave an outline of the arrangements for the forthcoming meeting of the above-named Institution (of which Mr. W. Foulis, M.Inst.C.E., is the President), which will take place in Glasgow on the 17th and 18th inst. We now learn, from the programme which has been prepared, that the members will be received on the morning of the first day at the Municipal Buildings, by the Lord Provost, Sir James Bell, and the members of the Gas Committee. Thence they will proceed to the Tradeston station, which they will inspect. On leaving, they will drive to the works of the Fairfield Shipbuilding and Engineering Company, where they will be received by Sir W. Arrol, and subsequently to the Dawsholm Gas-Works, where refreshments will be provided. An inspection will then be made of this and the contiguous Temple station; In the evening, the members will be invited by the Gas Committee to dinner in the Municipal Buildings. On the following day, a special saloon train will leave the Central Station for Gourock, where the *Duchess of Hamilton* will await the arrival of the party, and take them for a cruise, which, in view of the acknowledged beauty of the scenery of the west coast of Scotland, should, with fair weather, prove highly enjoyable.

English and German Coal.—The Coal Producers' Association of Upper Silesia has petitioned the Minister of Public Works, says the Berlin Correspondent of "The Times," to reduce the railway rates for the transport of coal from the Upper Silesian mines. The petition contains statistical evidence to show that during the first five months of the current year the amount of English coal imported into Germany increased by 119 per cent. as compared with the same period of 1895. It is further proved that, during the first five years of the present decade, the importation of English coal into the harbours of Stettin and Swinemünde increased by 118·8 per cent.; while the consumption of English coal in Berlin increased by 118 per cent. during the same period. The petitioners argue that, if coal from Upper Silesia could be substituted for English coal, the revenues of the Prussian railway administration would be increased by some 500,000 marks yearly, even if the present rates of transport were reduced. Nothing has yet been decided with regard to the petition; but there is no reason to suppose it will be rejected. How far Silesian coal can compete in point of quality with the English product has yet to be ascertained; but in view of a recent decision of the Russian authorities to employ Russian coal for the Navy, this petition from Upper Silesia deserves the serious consideration of English mine owners, as being calculated to strike a heavy blow at the English coal trade in the Baltic.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 428.)

THE past week was not altogether a happy time for the Stock Exchange—a number of disagreeable incidents cropping up which had a disturbing effect. Among these the Constantinople and Zanzibar troubles were conspicuous, but were not the only foreign sources of apprehension. Then at home came the possibility of more labour difficulties. On the other side of the account, matters in the American market looked a little brighter; and the settlement was satisfactorily got through. Had the week's troubles occurred at a busier time, they might have knocked prices down a good deal lower than they have actually fallen. The Money Market was much firmer, owing to the attraction of gold to the west; and rates are firm. Business in the Gas Market was very fairly active; and issues of all descriptions were firm and buoyant. Several considerable advances in quotations were made; and nothing moved in the other direction. The most noticeable feature was the great demand for choice debenture and preference stocks; those of the Gaslight and Coke Company being largely dealt in. Only moderate transactions took place in Gaslight "A," but at very steady figures; and it closed at an advance of a point. Of the secured issues which were also active, the 10 per cent. preferences were conspicuous with a gain of five points; and the "H" rose two. South Metropolitan was in high favour; and on Friday it changed hands at the handsome figure of 152½. Commercials were very quiet for want of stock. There were a few dealings in Suburbans and Provincials where stock could be obtained; everything commanding a good price. Bristol and Crystal Palace were the chief gainers on *ex div.* change. Several issues, which have for some time past been out of the list for lack of business, are now quoted again. The Continental division were steady and unchanged. The rest were mostly without feature; but Buenos Ayres had a small rise. Business in Water was extremely quiet; and hardly any change was effected. Chelsea preference had an advance; but Lambeth was a point easier.

The daily operations were: The Gas Market was extremely quiet on the opening day; scarcely anything being dealt in but Gaslight secured issues. Of these the "H" rose 2—Buenos Ayres also advanced ¼; and Tuscan debenture, 2. Business was much more brisk on Tuesday; and again Gaslight secured were in excellent demand. All the 10 per cent. preferences advanced 5. South Metropolitan rose 1. In Water, Chelsea preference was 2 higher. Transactions in Gas were much more restricted on Wednesday; but prices were good and buoyant. South Metropolitan rose 2 more. Business continued very quiet on Thursday; but everything commanded a good price, though quotations did not rise. There was more activity on Friday, and higher prices generally were realized; but still quotations remained unchanged. Saturday was firm and quiet; Gaslight "A" advancing 1. Lambeth Water was 1 lower.

ELECTRIC LIGHTING MEMORANDA.

The Geneva Congress of Electricians—Photometrical Units Again—The Nomenclature of Electrical Units—Electric Lighting at Mevagissey.

THERE has been another International Congress of Electricians—this time at Geneva, as a sort of side-show to the exhibition of electrical apparatus and machinery which has been going on there for a week or two, principally as a means of advertising German manufactures. There does not appear to be much difficulty about arranging an International Congress of Electricians. It does not greatly matter whether or not the leading institutions and societies connected with the science take any official cognizance of the gathering. All that is necessary is to procure the attendance of a few specialists of one or two different nationalities, and the thing is done. In the present instance, the English Institution of Electrical Engineers had nothing to do with the Geneva meeting, nor were any other important technical associations represented—a fact, as a technical journal has aptly observed, which deprives the congress of all international authority. But inasmuch as some previous gatherings of the same kind, for which official sanction has not been lacking, have not materially advanced our knowledge of the subjects of their deliberations, this shortcoming is not of itself sufficient to affect the prestige of the Geneva Congress. Was there not, in particular, a grand French Congress of Electricians, which distinguished itself, among other things, by the unanimous adoption of a set of electrical units that never got any nearer to universal acceptance for all the authority which was bestowed upon their inception? Formulating units of measurement is a favourite occupation for these congresses. At Geneva, M. Andre Blondel undertook to deal with the troublesome subject of photometrical units. Accordingly, he prepared a report, which was duly adopted, maintaining the integrity of the unit of light-intensity adopted by previous congresses. This is the so-called decimal candle = $\frac{1}{20}$ Violle, which is

notoriously neither a decimal nor a candle. There does not, as a matter of fact, exist any means of realizing this theoretical candle; and it would be instructive to hear how many physicists have succeeded in reproducing the Violle, and how they knew it when they had it. A much-needed concession to actuality however, was made at Geneva by M. Blondel, who admitted that, for practical purposes, the decimal candle can be provisionally represented, and "within a few feet per cent.," by the Hefner lamp. This last phrase, which we take from a report of the proceedings of the congress in an electrical contemporary, is delicious. Since the Geneva show was a German speculation, it was desirable to flatter the German pride in the national unit of light; but M. Blondel, being a Frenchman, and above all things a man of science, could not bring himself to neglect the Violle concept, while deferring, in regard to practical considerations, to the *genius loci*. To talk of the accuracy of a standard of light as being within "a few per cent." of the ideal is, moreover, a good example of the pedantry of scientism, which, if it has to guess at the radius of the circle, must nevertheless work out the circumference to four places of decimals.

A table of photometric units to suit was adopted by the congress on M. Blondel's recommendation. It is unnecessary to reproduce it here. The unit of intensity is the hypothetical candle already mentioned; the unit of "flux" is the "lumen;" the unit of illumination is the "lux," of one lumen per square metre; the unit of brilliancy is the candle per square centimetre; and the unit of quantity of light is the lumen-hour. What these all mean will be left to be puzzled out by the next unhappy student of problems of illumination who experiences the need of expressing himself in terms of exact measurement. His difficulty will not be lessened by the consideration that at least two, if not three, different "luces"—meaning the light received on a plane surface at a stated distance from the source of light—have been proposed by English writers on the subject. One of these is the light received by the surface at a distance of one foot from the source of light; while the other takes 12·7 inches as the distance. Anyhow, the distance proposed by the Geneva congress—one metre—is too great to possess any practical utility. The light derived from a candle at a distance of one metre is obviously below that now regarded as tolerable illumination.

The congress also resolved, on the invitation of M. Hospitalier, of Paris, to adopt the C.G.S. system of units of electrical measurement; adding to the resolution a declaration that it is not necessary to use very special nomenclature in this connection. The effect of this decision is to discredit the use of such names of derived units as the Gauss, Weber, Gilbert, &c., in magnetic measurement. This is all very well and sensible, inasmuch as such fancy appellations have never come into general use. But if the resolution also means that such terms as ampere, volt, or watt have not to be employed, it will be ignored, in view of the convenience and necessity of such nomenclature. On the whole, it does not appear that the Geneva congress differed greatly in the character of its proceedings, from any other gathering of electricians—some of them, at least, specialists of credit and renown. The development of the electrical industries will be neither hastened nor delayed by it. But the working bees of the profession will go on striving after their ideals in workshop and laboratory; and when their endeavours have borne fruit, the congresses of the future will register and discuss the results in the usual way.

One of the smallest and not least interesting of the electric lighting ventures in the country is a little undertaking recently started by a private Company founded under the auspices of Messrs. Veale, of St. Austell, for trying how electric lighting will answer the public and private needs of the fishing village of Mevagissey, on the South Cornwall coast. The place has been without organized lighting of any kind. Not a petroleum lamp previously helped to render visible the darkness of the primitive harbour and tortuous narrow lanes that served for streets; so that the leap to electric lighting was rather a bold one in the estimation of those who have learnt to regard this system as one of the luxuries of the age. Yet, in the circumstances, the experiment was not at all of a formidable character. A shed to accommodate a Paxman semi-portable engine to work the Crompton dynamo, and a set of accumulators, represents the central station; while the narrowness of the streets rendered the solution of the problem of distribution easy. A few 16-candle incandescent lamps on wall brackets constitute the public lighting; and sufficient private business has already been secured to give full employment to the present engine power during the coming winter. The supply is by meter, at 6d. per unit; so that this remote Cornish village enjoys a cheaper service than the City of London. Whether or not the undertaking will pay dividends is, of course, as yet problematical; but the whole fit-up is an example of strictly economical and efficient electrical engineering. It is almost needless to say after this that no consulting engineer had anything to do with the planning of the installation. The working appears to give satisfaction in the village, although there have been a few hitches to confirm the more cautious householders in their attitude of watching results before lending their support to the somewhat audacious scheme. There have been several tentatives towards the establishment of a small gas undertaking in the district, which have come to nothing; and now the opening for anything of the kind seems to be closed for the time being. The example is probably unique, and its future will be worth watching. If the field of operations is small, electricity will have it entirely to itself; and we can but wish prosperity to the modest but enterprising little Electric Light Company that has undertaken a work which the most venturesome of contracting gas engineers have either overlooked or shrunk from.

DR. H. LUX ON THE LIGHTING OF BERLIN.

No one was more capable of collating the immense mass of official documents and statistics relating to the public lighting of Berlin than Dr. H. Lux, the Editor of the "*Zeitschrift für Beleuchtungswesen*;" and the volume of nearly 500 imperial octavo pages now before us* testifies to the conscientious manner in which he has performed his self-imposed task. The book should have a wider circle of readers than that to which its title would naturally give it access; for in reality it presents an excellent survey of the present position of gas manufacture and of the supply of electrical energy throughout Germany. Berlin is the largest, and it is also a typical German city; and, especially in the matter of the lighting industries, it serves to illustrate principles and methods that have a wider field of application. Hence we offer no further apology for briefly reviewing *seriatim* the contents of Dr. Lux's work.

The first chapter is historical, and divides the story of the lighting of Berlin into three sections. The first section embraces the period from 1680, when the first attempt to light the streets was made, to 1825, when a contract was entered into with the Imperial Continental Gas Association to light the town—partially by gas, partially by oil-lamps. The second section covers the period from 1825 to 1860, from which year very great strides were made towards the improvement of the public lighting. The third section brings the story up to 1895.

The second chapter deals with the production of gas in Berlin. There are five municipal works, and three owned by the Imperial Continental Gas Association. The make of gas in the year 1893-4 was 3630 million cubic feet at the municipal works, and 1180 millions at the Association's works. Berlin and the suburbs are now estimated to consume about 7000 million cubic feet of gas a year. Upper Silesia furnishes the greater part of the coal carbonized at the city works. About one-fiftieth part only comes from England. The average make of gas per mouthpiece per day during the past year was 9645 cubic feet. The retorts were drawn and recharged six times daily. Of the entire number of retorts in action, 91·3 per cent. had generator firing. The majority of the new settings have furnaces of the improved Munich pattern. Dr. Lux explains very lucidly, by the aid of excellent illustrations of the Munich setting, the application of the regenerative system to retort-furnaces. In the recently-erected houses, Morton's self-sealing retort-lids have been adopted. Drawing and charging are still done by manual labour at all the city works; but Dr. Lux illustrates the mechanical stokers in use at the neighbouring works at Charlottenburg. A tubular condenser with water circulation is the only type mentioned; and it is possible that the forced economy of space precluded the use of atmospheric condensers. But we believe German gas engineers do not regard the latter with favour under any conditions. Bog oxide is the only purifying material now used. Körting's steam-jet exhauster is employed at one works, and reciprocating exhausters at the others. Those of the rotary type appear to pass unnoticed. The coal carbonized in 1893-4 gave the following percentages by weight of products: Coke, 62·1; tar, 5·03; ammoniacal liquor, 9·8.

Distribution is dealt with in the third chapter. The municipal works supply 167 miles of mains; and the Association's works, 70 miles. The average consumption per head of the population decreased slightly during last year, owing to the more general adoption of the Welsbach light. The latest annual return gives it as 2860 cubic feet. The leakage amounted to 4·49 per cent. of the production, and was therefore higher than in many of the other large towns of Germany. There are now 1553 gas-engines in use.

The fourth chapter deals with the application of gas to lighting purposes, and incidentally with photometry. The English sperm candle is used for testing; but the consumption of sperm is ignored, and readings are invariably made at a flame-height of 45 mm. (1·77 inches). The gas under examination is burnt in an argand burner with 32 holes at the rate of 150 litres (5·297 cubic feet) per hour. The average illuminating power for the year of the gas sent out from the municipal works was 17·3 candles; or corrected to a consumption of 5 cubic feet per hour, 16·3 candles. Dr. Lux mentions several other standards of light, and also describes, with the aid of illustrations, a radial photometer. Some special portable apparatus for taking the illuminating power of street-lamp burners *in situ* is also mentioned. The gas is examined for ammonia by a saturation test which indicates a quantity exceeding 0·75 grain per 100 cubic feet. Sulphuretted hydrogen is looked for; and the amount of carbonic acid in the gas is roughly determined. No notice is apparently taken of sulphur compounds other than sulphuretted hydrogen. In June, 1895, there were 25,504 gas-burners employed for street lighting, of which the greater

* "Die öffentliche Beleuchtung von Berlin." Von Dr. H. Lux. Berlin: 1896.

number were of the ordinary batswing type, each consuming about 7 cubic feet of gas per hour. There were only 55 Welsbach burners in use for street-lamps. Some of the standards and lanterns are of a highly ornamental character. Several types of regenerative and incandescence burners are lucidly described. A few burners are furnished with electric igniting apparatus.

The fifth chapter deals with the administration of the Gas Department. The price of gas for lighting purposes is at the rate of 4s. 6d. per 1000 cubic feet; but if supplied for other purposes by a separate meter, the price is only 2s. 10d. Meter-rents are charged. The cost of public lighting in Berlin has steadily increased year by year.

The next chapter deals with the production of electrical energy at the Berlin stations. Electric lighting was virtually not introduced until 1883, when a concession was granted to the German Edison Company to light a portion of the city. In August, 1885, the first large works were opened. They had six machines, giving a total of 900-horse power. The electrical stations can develop 20,100-horse power. After very complete descriptions of the plant in use at the various stations, we find the following statement, which must be highly gratifying to the inhabitants of Berlin: "In consequence of the technically superior disposition of the plant and of the unsurpassed system of working, the Berlin central stations attain the highest commercial efficiency. They yield at the place of consumption, on an average throughout the year, a current of 254 watts for every pound of coal consumed. No other central station in the world has achieved such a result."

The seventh chapter treats of the distribution of electrical energy. The apparatus essential to it is described at length; and an elaborate plan of the city, showing the area of supply, is given. Transformers, switches, meters, and cables are all fully dealt with; and the precautions taken to minimize the risk of accidents are mentioned. We notice that possible danger from the formation of explosive gas from the moisture in the culverts is one case considered; and our own electrical engineers would be well advised if they studied the precautionary measures adopted in Berlin. Space in the street-boxes and culverts in which coal gas might accumulate is avoided as far as possible; and when it must inevitably be left, ample ventilation is provided. In the succeeding chapter, the application or consumption of electrical energy is dealt with. The total annual production for 1893-4 was equivalent to 7,556,787 kilowatt-hours, of which 15·8 per cent. was unaccounted for. The price per kilowatt-hour for lighting purposes is now 60 pfennige (about 7d.) subject to certain abatements to large consumers.

The ninth chapter treats of the actual lighting. We find in it a comparison—based on reasonably fair assumptions—of the relative duties of various systems of lighting per unit of energy consumed. The following are the figures: Large batswing gas-burner, 90; large argand gas-burner, 106; electric incandescent lamp, 170; Schülke's regenerative gas-burner (26·5 cubic feet per hour), 200; incandescent gas-light, 520; electric arc light, 1000. The efficiency of the incandescent electric lamp is very low; and this is the reason of its replacement in many cases by the incandescent gas-light. All the more important examples of standards and candelabra in use for the electric light in the streets and public buildings of Berlin are described by Dr. Lux, and numerous illustrations are given.

In the next chapter, the administration of the electrical works of the city is dealt with. The profit realized in 1894-5 sufficed for a dividend of 12¼ per cent. on the subscribed capital.

In the eleventh chapter, various means of lighting are briefly considered. Petroleum is the chief; and several patterns of regenerative mineral oil lamps are described. Oil gas and naphtha vapour lamps are touched upon; and there are a few remarks on public illuminations.

In the twelfth chapter, the author gives statistics of the lighting of all towns in Germany of more than 50,000 inhabitants. It should prove invaluable to those seeking such information for purposes of comparison.

The final chapter treats of the illuminating effect of the various lamps in use. The following values for some units of light are stated to be from recent determinations: Violle's platinum unit, 18·5 English sperm candles, at a flame-height of 45 mm.; the carcel unit, consuming 42 grammes of oil per hour, 8·9 candles; the German paraffin candle, at a flame-height of of 50 mm., 1·13 candles; the Hefner unit, at a flame-height of 40 mm., 0·94 candles. This chapter is perhaps the most valuable one in the book. There are numerous diagrams showing the degree of illumination of a road by various burners at different distances apart. These are worthy of the attention of everyone concerned in the lighting of streets and open spaces. The ideal public lighting is considered to be that which enables medium-sized print to be read at any position in a street; and probably this ideal is attained only in Paris.

Much arduous labour must have been bestowed upon the compilation of this really valuable work; and Dr. Lux has earned the gratitude of his fellow-technicians for the devotion of his abilities to it.

Iron and Steel Institute.—The bulk of the members of the Iron and Steel Institute, who are going on a visit to Bilbao (where the autumn meeting of the Institute will this year be held), departed on Saturday from St. Pancras Station for Tilbury, to embark on the *Ormuz*, the Orient steamship.

NOTES.

Japanese Coal.

An analysis of Japanese coal has been made by Mr. Frank Browne, F.C.S., the Acting Government Analyst at Hong Kong, and the results have been given in the "Chemical News." The sample examined was that variety known as Tubari coal, from the island of Yezo. It was in large black lumps, which when broken gave a dark chocolate-brown powder. It burned readily, giving at first a bright smoky flame, which disappeared after a short time, leaving a glowing mass. It is a non-caking coal. The results of the analysis show high percentages of volatile combustible matter and of ash. It consisted of moisture, 3·83 per cent.; volatile combustible matter, 36·62 per cent.; fixed carbon, 42·70 per cent.; and ash, 16·85 per cent. Ultimate analysis of the dried coal gave the following percentages: Carbon, 62·84; hydrogen, 6·37; nitrogen, 1·08; oxygen (calculated), 11·01; sulphur (combustible), 1·18; and ash (containing 0·49 per cent. of sulphur), 17·52. The relative density (water at 15·5° C. = 1) was 1·411. The heat of combustion, calculated from the formula 8080 C + 34,462 (H − o/8) + 2220 S, gave 6826 calories.

The Repair of Retorts in Use.

At the last meeting of the Société Technique du Gaz en France, M. Soubiran described the system he has adopted of repairing retorts while they are in use. At the outset, the author laid down the proposition that, in order to bind two materials together with mortar, their surfaces must be free from dust and freshly washed. This equally applies to plastering. In the case of retorts at work, however, it is advisable not to use a great deal of water, as too sudden contraction would be produced. The author therefore applies it in the form of spray, under good pressure. Before using any of the customary mortars or mastics for filling up cracks, he sprays the latter with a liquid mixture of cement or grout to which has been added about 1-20th part of borax. The particles of this material adhere perfectly to the surface, and form a priming for the mortars which are to be used for filling the larger crevices. After these have been attended to, he sprays the whole of the surface, in order to stop up any of the smaller, and sometimes almost imperceptible, cracks. The advantage of having the material in a liquid condition is that it can be applied at a number of points possibly not otherwise within reach, and will allow of the surface being covered to any thickness the operator may desire. It is claimed that scurfing can be more easily done with M. Soubiran's system, and, moreover, without injury to the retort itself.

The Determination of Sulphur in Illuminating Gas and Coal.

Mr. C. F. Mabery has been dealing with the above subject in the "American Chemical Journal;" and his investigations have been summarized in the "Journal of the Society of Chemical Industry." For testing gas, the combustions were made in a glass tube 45·5 centimetres long, constricted at 30 centimetres from the forward end. The jet, of hard glass tube, is connected with a gas-meter; a pinch-cock and a wash-bottle containing a little water being interposed for the better regulation of the gas supply. The air current enters through another tube, which communicates with the outside of the laboratory; and the rate of flow is kept up by some kind of exhaust. For the absorption of the products of combustion, a U-tube, 34 cm. high and 25 mm. internal diameter, partially filled with broken glass, is used, containing 1-100th normal caustic soda solution; this strength being found to retain the sulphuric acid perfectly. Titration is effected by 1-100th normal sulphuric acid, with methyl-orange as the indicator. The results obtained do not vary beyond the limits of error—the oxidation and absorption being complete, as was shown by the fact that the addition of hydrogen peroxide to the caustic soda solution did not effect any change in the results. The author is convinced, from numerous determinations made with asphaltes, coal tar, petroleum products, and gas, that the method leaves nothing to be desired on the score of simplicity and precision for organic bodies leaving no inorganic residue. In examining coal, the combustion is performed in a tube of very hard glass (in length 40 cm. beyond and 25 cm. behind the constriction); the substance being inserted in a platinum boat. A rapid stream of air is allowed to enter at the constriction, and a slower current (to carry the volatile matters forward and assist the combustion) from behind. The U-tube contains 30 c.c. of decinormal, or 1-5th normal, caustic soda; the titration being performed as in the examination of gas, but with correspondingly stronger acid. Some care is needed during the distillation of the volatile matter, which for 0·5 gramme of coal will take 20 minutes—a further 10 minutes being required for burning off the fixed carbon. Suitably modified, it might, in the opinion of the author, be possible by this method, with an inert gas, to distil off the volatile matter, and weigh the fixed carbon before completing the sulphur determination.

Minerals in Coal Ashes.

The occurrence of vanadium and the platinum metals in the ash of certain coals has already been notified. Professor Blake has found these remarkable "residuals" in the ash of some New South Wales coals; and quite recently some anthracite from the Andes has yielded them in appreciable quantities.

According to a statement of Mr. D. T. Day, in the "Engineering Magazine," the market value of the New South Wales sample is governed by its richness in platinum. The coal in question contains 1·7 per cent. of ash, and this ash contains 25·1 per cent. of metallic vanadium, and 3·6 per cent. of platinum metals. This means that the raw coal would yield per ton 144 oz. 16 dwt. 3 grs. of metallic vanadium, and 20 oz. 13 dwt. 11 grs. of platinum metals. Another sample of coal, of origin not stated, but containing 15 per cent. of ash, would yield 146 oz. 17 dwt. 8 grs. of metallic vanadium, and 11 oz. 13 dwt. 8 grs. of platinum metals. It is a matter of regret with American workers in the incandescent electric lamp industry that there is no native source of any importance of the platinum which is indispensable in this and other arts; and Mr. Day evidently hopes that the metal, with or without vanadium, might be found in some veins of native coal supply not tested with this object. It may be suggested that, as large quantities of anthracite are being reduced to ashes every day in the water-gas cupolas of the States, the residues of these very perfect coal consumers might be searched for their secret mineral wealth.

Gas-Furnace for Mechanical Dentistry.—At the annual meeting of the British Dental Association, there was on view a crown and bridge furnace designed and made by Messrs. Fletcher, Russell, and Co., Limited, which attracted much attention. It had a muffle of welded platinum which was capable of attaining a clear white heat in one minute, starting all cold.

Additional Capital for the Melbourne Gas Company.—According to a telegram, dated the 24th ult., received through Reuter, tenders for the issue by the Metropolitan Gas Company of Melbourne of £35,000 of 4 per cent. debentures were opened on the previous Friday. The amount was subscribed more than three times over; and the allotment was made at an average premium of £3 2s.

A Chadwick Prize Shield.—The Trustees under the will of the late Sir Edwin Chadwick propose, in the month of January, 1899, to give a shield worth £100, to be called the "Chadwick Shield," to that local authority, presiding over a population of not less than 50,000 inhabitants, which, having adopted the most complete application of the separate system of drainage, shall during the preceding five years show the best reduction of the death-rate in its district, as indicated by official statistics.

Experiments with Nitrogenous Manures.—A pamphlet has been issued by the Agricultural Department of the Glasgow and West of Scotland Technical College, containing reports on experiments on the manuring of oats, hay, and turnips, on "finger-and-toe" in turnips, and on the spraying of potatoes, conducted in 1895 by Professor R. P. Wright and others on farms in the south-west and centre of Scotland. The results of the experiments upon the oat crop indicate that nitrogenous manures, such as nitrate of soda and sulphate of ammonia, applied alone, retard ripening, but give large and profitable, though somewhat irregular, increases of crop; also that these nitrogenous fertilizers are more uniform and more regular in their action when applied with a soluble phosphatic manure, particularly superphosphate of lime.

Received.—"A Treatise on Industrial Photometry, with special application to Electric Lighting." By A. Palaz, D.Sc., Professor of Industrial Electricity in the Science Faculty (Engineering School) of the University of Lausanne. Authorized translation from the French by G. W. Patterson, jun., M.A., B.S., and M. R. Patterson, B.A. (London: Sampson Low, Marston, and Co., Limited.) "L'Ammoniaque: Ses Nouveaux Procédés de Fabrication et ses Applications." Par P. Truchot, Ingénieur-Chimiste. (Paris: B. Tignol.) Catalogue of Chemical Apparatus and Chemicals manufactured and sold by Philip Harris and Co., Limited, of 144 and 146, Edmund Street, Birmingham. This book contains a great variety of apparatus for gas analysis (among the newest shown being the Orsat-Pryce apparatus), testing the viscosity and the flash-point of oils, &c. "The London Manual and Municipal Year Book for 1896-7." ("London" Office, 125, Fleet Street.) A very useful manual containing a great deal of information concerning public bodies presented in a compact form.

The First Petroleum District in Russia.—The district of Ter was the first, says the "Journal of the Society of Chemical Industry," to be worked for petroleum in Russia; refineries being erected at Mosdok. Oil was discovered in the Grosney field in 1833; but it was only obtained in small quantities, and from a few shallow wells. On boring deeper, the yield was, however, increased; the most productive well being that bored by the Suart Company in 1895, which spouted to a height of 100 metres, and yielded during the first few days some 800,000 poods per diem. The Grosney oil contains 15 per cent. of petroleum spirit, but comparatively little burning oil. The residue, amounting to about 55 per cent., has a specific gravity of about ·960, and flashes at 120° to 130° C. As a lubricating oil, it was preferred to Baku residuum; but it is too thick to spray for fuel, and the crude oil is too inflammable. The refiners therefore simply distil off the spirit, and sell the remainder for heating purposes, now that petroleum is cheap and the demand for lubricating oils insufficient.

TECHNICAL RECORD.

MANCHESTER DISTRICT INSTITUTION OF GAS ENGINEERS.

Quarterly Meeting at Widnes.

For the One-Hundred-and-Seventh Quarterly Meeting of the Manchester District Institution of Gas Engineers, held last Saturday, a very extensive programme had been prepared, the due execution of which kept the members together for about ten hours—a time full of interest and instruction to all who were fortunate enough to attend the invitation issued to visit Widnes, the gas and water works of which town are under the management of the President of the Institution, Mr. Isaac Carr, Assoc. M.Inst.C.E.

Leaving Manchester at 10.45 a.m., Farnworth was soon reached; and here conveyances were waiting to take the party to Widnes—the drive being arranged so as to afford a sight of some of the principal portions of the town. On reaching the gas-works, light refreshments were served; and Mr. Carr took the opportunity of announcing that he had prepared a pretty full description of both the gas and water works, so as to assist the members in their inspection of the plant, which he desired should be exhaustive in every respect. This description [see p. 410] will indicate what, from a technical point of view, occupied the attention of the party during the remainder of the day. At the gas-works, of course, the main interest centred round Mr. Carr's adaptation of the Dinsmore process—a modification now so extensive as to almost justify dro pping out of sight the original patentee, seeing that little now remains at Widnes beyond the bare suggestion contained in the patented process which Mr. Carr determined years ago to try, and the plant for which he has had to alter and adapt so as to make it work satisfactorily. It may be remembered that Mr. Carr described what he was doing in this respect in a paper which he read before the Institution in 1889; and further reference to the subject was made in his Inaugural Address last February. Apart from this tar-carburetting plant, much interest was shown in the extensive series of alterations and additions Mr. Carr has been carrying out at the works during the last few years, and much of which is already completed.

A move was next made to the gasholder station on the other side of the town, at Ditton, to afford an opportunity for an inspection of the three-lift Gadd and Mason columnless gasholder of 700,000 cubic feet capacity, which has now been satisfactorily at work since 1893—not having caused the slightest trouble from the first day it was brought into service for the gas supply of the town and district.

A very pleasant drive brought the party to the Pex Hill reservoir station of the Corporation, from which an extensive and beautiful view of the surrounding country is obtainable on a clear day such as Saturday. In a large pavilion at Pex Hill arranged for the accommodation of pleasure parties, the members of the Institution were formally received by the Mayor of Widnes (Mr. Alderman Sadler, J.P.), who was accompanied by Mr. Alderman Timmis, the Chairman, and several members of the Gas and Water Committee. A generous luncheon was here provided by the Committee; and at its close—after a few toasts had been given—Mr. W. R. Chester, of Nottingham, in glowing terms, proposed a vote of thanks to the Mayor and the other members of the Corporation for their courteous reception of the Institution, and the hospitality they had displayed throughout the day. The vote was passed by acclamation, and suitably responded to by Mr. Alderman Timmis.

The only ordinary business of the meeting was then transacted. It consisted of the reading by the Hon. Secretary (Mr. S. S. Mellor) of the minutes of the previous quarterly meeting, and the election of three new members—Mr. Henry Lawton, of Carnforth, Mr. Matthew Dunn, of Selby, and Mr. F. H. Pickles, of Kildwick.

A photograph of the party having been taken, the conveyances were again requisitioned for a drive to the Stocks Well pumping station, and then to the Netherley pumping station, where 2¼ million and 4 million gallons of water per day respectively are obtained from boreholes sunk in the new red sandstone formation. The machinery at both places, as well as the general arrangement of the plant, was much admired and commented upon.

The afternoon was now far advanced, so that a rapid drive was necessary to enable the party to reach the Childwall Abbey Hotel in time for tea at 6 o'clock. Subsequently a short time was spent in the pleasure gardens surrounding the hotel before the train was due to leave in order to reach Manchester shortly before 9 o'clock. The outing was certainly one of the most pleasant the Institution have had for many years; the enjoyment being enhanced by the care shown by Mr. Carr, in conjunction with Mr. Mellor, in the details of the arrangements, so that, while there was ample time for everything all day, there were no long waits at any place and no hurrying through the items of the programme towards the end of the day, as is sometimes necessary.

WIDNES CORPORATION GAS AND WATER WORKS.

[Address delivered to the Manchester District Institution of Gas Engineers by the President, Mr. Isaac Carr, Assoc.M.Inst.C.E., Aug. 29.]

The Widnes Gas and Water Works were founded by a private Company in 1860, and in 1867 were acquired by the late Local Board, under the special provisions of the Widnes Improvement Act of that year. At the time of the transfer, the consumption of gas was 13 million cubic feet, and of water 20 million gallons, per annum.

Since the foregoing period, the annual consumption of gas has increased to 183 million cubic feet, and that of water to 1026 million gallons, per annum. To meet these increases, large extensions have been, and are being made, which, when completed, will bring the capacity of the gas-works up to 1½ million cubic feet per diem, or (say) equal to a consumption of 350 millions per annum, and that of the water-works to 2000 million gallons per annum.

Gas-Works.

The extensions at the gas-works are, with the exception of a new retort-house, now completed.

Retorts.—The carbonizing plant at present consists of 188 mouthpieces, capable of producing one million cubic feet of gas per diem. Of the above number, 140 are in one retort-house, in settings of sevens, fired by ordinary furnaces; the local circumstances not permitting of the introduction of the regenerator system. The remaining 48 mouthpieces are in a second retort-house, and are in settings of sixes with a duct, and heated by Chester's regenerator furnaces.

Tar Plant.—This latter lot comprises the tar carburetting plant described by me in a paper read before this Institution in November, 1889, and also alluded to in my Inaugural Address in February last.

The new retort-house will contain 112 horizontal retorts, in settings of sevens, heated with regenerator furnaces.

Condensers.—The new plant, recently inaugurated, commences with the condensers. The first is a slow-speed atmospheric condenser, consisting of a 30-inch pipe, 103 feet long, laid in a brick trough below the yard level, and covered with iron plates; provision being made for a current of air, the quantity of which can be regulated, to be drawn through. From this the gas enters a second condenser of the water-cooled type, which is constructed on the general principle of this class of apparatus.

Exhausters.—The exhausting plant comprises two combined horizontal engines and rotative exhausters; the capacities being 40,000 and 80,000 cubic feet per hour respectively. Steam is supplied from boilers fitted with patent force-draught furnaces for the consumption of breeze and refuse fuel; and for additional efficiency, the boiler feed-water is heated to boiling-point on its way to the boilers by the exhaust steam from the engines in a Berryman patent water-heater.

Washer and Scrubbers.—From the exhausters the gas passes through a Livesey washer into the scrubbers. These are 12 feet in diameter and 58 feet high; the total height being 78 feet. The filling consists of canvas screens. A notable feature in connection with them is that the 12 feet rings of the body are cast in one complete piece, each 5 feet deep, instead of in segments; thus forming an enormous casting so large that it could not be conveyed by rail. The contractors—the Widnes Foundry Company—were enabled to carry out the work as described owing to the proximity of their works; the advantages being that the scrubbers are neater looking through having fewer joints, and the cost of erecting was considerably less.

While speaking of scrubbers, I cannot allow the opportunity to pass of claiming the inventor of the scrubber or its prototype as a Widnes gentleman (*vide* "King's Treatise on Coal Gas"). In 1836, the late Mr. William Gossage, the founder of the firm of Messrs. William Gossage and Sons, Soap-Works, Widnes, invented the scrubber as part of an apparatus used by him in the decomposition of common salt. This apparatus was copied by gas engineers; and to-day it forms one of the most important and remunerative adjuncts to the purifying plant in gas-works throughout the whole world.

Purifiers.—The purifiers are six in number, 20 feet square and 6 feet deep; four working with oxide and two with lime. Revivification of the oxide *in situ* is effected by the injection of steam and air at the centre-valve inlet.

Station Meters and Governors.—The station-meter house contains two meters of 45,000 and 25,000 cubic feet per hour capacity respectively; also two 14-inch station governors supplying different levels of the district. The whole of the valves and connections throughout the works are 16 inches in diameter.

Tar and Liquor Wells.—Extensive storage accommodation for tar and ammoniacal liquor has been provided by converting an old gasholder tank, 53 feet in diameter and 20 feet deep, into two separate wells, one for tar and one for liquor, having a total capacity of 700 tons. The wells are covered with a strong roof in rolled steel joists and concrete, supported from the under side with a brick cross wall built in hydraulic mortar. The covering of this tank has effected a valuable increase in the yard space at a point where additional room was greatly needed. The tar and liquor flowing from the various points in the works are passed through a separator, from which they overflow to their respective wells. A special feature in the tar-well is that the bottom is formed in an inclined plane falling to the pump suction, which is a permanent fixture at the bottom of a sump hole. The advantage is that the heavy tar gravitates to the suction, and is pumped on first; and thus all the tar and the whole of the well space are kept available. With the old arrangement of a flat-bottom well and a movable suction-pipe, thick tar, which sometimes cannot be pumped, accumulates in such quantities as to cause serious inconvenience through the reduction of the storage capacity, to say nothing of the practical loss of the tar.

Pump-House.—The tar and liquor pump-house is surmounted by a cast-iron tank of 25 tons capacity, into which tar is pumped for the purpose of filling railway tank-waggons with the greatest possible despatch.

Sulphate-House.—The sulphate-house is spacious; storage for 100 tons of sulphate being provided. The capacity of the plant is 1½ tons of sulphate per diem. The saturator is fitted with a Wilton's discharger. Oxide of iron purifiers of ample capacity are provided for absorbing the waste gases.

Mortar-Mill.—On one side of the boiler-house is erected a large mortar-mill for grinding the retort-house ashes into mortar. The ashes are somewhat costly to dispose of, yet when converted into mortar they find a ready sale to various building contractors in the town, and at the same time form an additional and a profitable source of revenue.

Railway siding accommodation is provided throughout the works. The workshops, stores, testing-rooms, and offices are light, commodious, and well ventilated.

There is one gasholder of 100,000 cubic feet capacity remaining on the gas-works site (three small ones having been previously removed); and this is shortly to be taken down to provide additional yard and coke storage space.

Gasholder Station, Ditton.—The gasholder storage station is situated in Ditton, outside the borough boundary, and 1½ miles from the gas-works. Here is an ordinary two-lift holder of 400,000 cubic feet capacity, and also a three-lift Gadd and Mason patent columnless gasholder of 700,000 cubic feet capacity, erected in 1893. The tank is 118 feet in diameter by 24 feet deep; and the holder, when fully extended, rises to a height of 72 feet. The total storage capacity, including the holder at the gas-works, is 1,200,000 cubic feet. There is a 12-inch governor and check meter at this station, for supplying gas to the Ditton, Halebank, and Hale districts. Sufficient land has been acquired at the Ditton site for the erection of additional works of 1,500,000 cubic feet capacity per diem.

Number of Consumers.—The total number of consumers is 3838, of which 1998 are consumers by "penny-in-the-slot" meters.

Price of Gas.—The selling price of the gas within the borough is 1s. 8d. and 1s. 10d. per 1000 cubic feet net.

Free Public Lighting.—The gas undertaking contributes to the relief of the general district rate of the borough by doing the whole of the public lighting free of cost, which amounts to a charge of almost 3d. per 1000 cubic feet on the gas sold.

Gas-Works Capital.—The total capital expended on the gas-works, including the original purchase-money, up to the 25th of March last, was £83,435, of which sum £23,738 has been paid off through the sinking fund and the profit and loss account; leaving the actual capital £59,697, or equal to £3 4s. per ton of coal carbonized.

Water-Works.

The water-works consist of two pumping-stations—one being situated in Ditton, and known as Stocks Well; and the other in Little Woolton, and known as Netherley. The former is 3 miles, and the latter 5¼ miles, from the centre of Widnes. There are also two service reservoirs on Pex Hill—the highest ground in the district, being 218 feet above the level of the Mersey, and 193 feet above the works' district; thus affording an excellent pressure of water throughout the town. The water is obtained from deep wells and boreholes sunk into the new red sandstone formation.

Stocks Well Pumping-Station.—Stocks Well is the old station; the first portion having been erected in 1868. It comprises a pair of 50-horse power double-acting beam condensing engines, which formerly pumped from a well 10 feet in diameter and 60 feet deep. From the bottom of this well, a 14-inch borehole is sunk a further depth of 440 feet. Some years ago, the suction to the pumps was placed in the borehole, as the water did not rise into the well in sufficient quantity. The pumping capacity of these engines is a million gallons per diem. The second well and machinery were put down in 1875; the well being 10 feet in diameter and 62 feet deep, with a 24-inch borehole carried down a further depth of 250 feet. The engine is a single-acting condensing engine of the Bull Cornish type, and of 150-horse power. The pumps formerly were on the bucket and plunger principle, and pumped the water from the well; but in 1886, owing to the water having ceased to rise into the well in sufficient quantity, a new open lift double-bucket pump was fixed in the borehole, with the suction 90 feet down. The result of this alteration was that the yield of the well, which had fallen to 600,000 gallons per diem, was increased 1½ millions. The total height the water is lifted to the reservoirs is 250 feet. The steam for the engines is supplied by three 30 feet by 7 feet Lancashire boilers.

A dangerous but interesting feature at this station is that the red sandstone rock through which the wells and boreholes are sunk is of an exceedingly soft nature. Sand is

continually coming up with the water; and great difficulty has for years past been experienced owing to the subsidence of the wells from this cause. More especially does this apply to the well above alluded to; and at the end of last year, so serious did this become that it was not considered safe to continue working this engine. The nature of the subsidence is that about 30 feet of the bottom portion of the well, upon which the pumps should rest, has broken away, and bodily settled down a distance of 4 feet—fortunately leaving the upper portion, which carries the engines and buildings, standing firm. What is actually happening is that the foundations are being continually pumped away. Hundreds of tons of sand have been thus brought out, leaving behind the well casing enormous cavities, which have from time to time been filled in with concrete. At the present time there are large cavities to be seen 30 feet from the ground-level. Operations with the view of permanently remedying this settling are now in progress. The scheme consists of widening the 24-inch borehole to 36 inches for such a distance down until rock was found sufficiently hard to carry a permanent foundation. Hard rock was met with at 86 feet below the well bottom, or 152 feet below the ground-level; and upon the shoulder formed by the widening has been placed a 30-inch cast-iron cyclinder, which is carried up to stand 10 feet above the bottom of the well. The lower portion of the cylinder is perforated, so as not to interfere with the inflow of water to the borehole pump. The upper part is solid; and the space between the upper outer portion of the cylinder and the rock is filled in with concrete, which is carried up under and inside the well-casing to the level of the top of the cylinder. It is confidently expected that this will form a permanent and immovable foundation.

Stocks Well Extension.—It is proposed to duplicate the plant at this station with a pump on the lines of the new one at Netherley, subsequently alluded to. The capacity will be 3 million gallons per diem; and the estimated cost £12,500, including new high-pressure steel boilers.

Netherley Pumping-Station.—The Netherley station was acquired in 1875, when an oval well, 12 feet by 9 feet and 100 feet deep, and a 24-inch borehole for a further 200 feet, were sunk. The well is surmounted by a 150-horse power single-acting condensing engine of the Bull Cornish type, similar to the one described at Stocks Well, and capable of pumping 1¼ million gallons per diem. The pump consists of an open lift well-pump, discharging into an open cistern at the top of the well, in which cistern the plunger or force-pump sits, and forces the water to the reservoirs, a distance of about five miles, with a total lift of 270 feet.

Borehole Scheme of Pumping.—In 1892-3, to meet the increasing demand for water, a second pump of 2¾ million gallons capacity per diem was put down. To avoid the enormous cost of sinking a well for the accommodation of a pump of so large a capacity, it was arranged to sink boreholes from the surface, and adapt the pumps to suit. Two boreholes, 30 inches in diameter and 20 feet apart, were sunk to a depth of 200 feet to hold the pumps, and were carried down 18 inches in diameter a further depth of 200 feet in one borehole and 400 feet in the other; making the total depth of the two 1000 feet. The boreholes are cased with cast-iron tubes for a distance of 35 feet down, at which point the rock was found sufficiently hard to be self-supporting. The estimated total saving in capital outlay in substituting the boreholes for the well is £15,000. The estimate is based on the cost of the well already on the site.

The engine, which was built by Messrs. Hathorn, Davey, and Co., of Leeds, is a horizontal direct-acting compound engine, having 32-inch and 60-inch cylinders and a 6 ft. 3 in. stroke. It works two sets of pumps, a pair of 18½-inch diameter and 6 ft. 6 in. stroke open lift-pumps in the boreholes; the suctions being 200 feet down. The water from the borehole pumps is delivered into a tank under the engine-house floor, from which a double-acting piston force-pump, 18½ inches in diameter and 6 ft. 3 in. stroke, takes the water, and forces it to the reservoirs—a total rise, including friction head, of 361 feet. The engine was required by the Corporation to do a duty of 90 million foot-pounds on 112 lbs. of coal on an evaporation of 9 lbs. of water per pound of coal. The penalty of the contract was £50 per million for each million below the specified 90; while a premium of £25 per million was offered for each million by which the duty should exceed that specified. The average result of the tests, extending over a period of three days, was 109·6 millions—one of the highest duties ever obtained from engines of this type. The premium earned amounted to £475. I may mention here that this engine was fully illustrated and described in the "Engineer," for Sept. 15, 1893.* The total cost of the scheme, including the boreholes, foundations, engines, pumps, buildings, and premium, was £10,450. This works out to the extraordinarily low capital cost of 2·5d. per 1000 gallons of water pumped per annum, which is claimed to be a "record," taking all comparative circumstances into consideration.

The total pumping capacity of the station is 4 million gallons per diem. Steam is supplied from four Lancashire boilers, 26 feet long and 6 ft. 6 in. diameter.

Both stations are noted for the purity of the water and the abundance of the supply. The average total hardness being under 10 per cent. renders it a highly suitable water for manufacturing and general domestic purposes. The consumption last year, as previously stated, was 1026 million gallons, which amounts to 80 gallons per head per diem, 60 gallons of which are registered through meters for manufacturing purposes.

Belle Vale Site.—The Corporation are the possessors of a site for a third pumping-station known as Belle Vale, situated a mile beyond Netherley, and six miles from Widnes. A 3-inch borehole is sunk to a depth of 300 feet, from which a stream of 2500 gallons per hour flows continually all the year round.

Pex Hill Reservoir Station.—The two covered service reservoirs on Pex Hill when full will hold 12¾ million gallons—the old one 1¾ millions, and the new one 11 millions. The latter, at the time it was made, was the largest covered reservoir ever erected. The small reservoir is constructed of brick wall, and rendered water-tight with puddle backing. The large reservoir is built with the red sandstone excavated on the site, and made water-tight by a lining of asphalte, which is run in the outer walls and returned under the floor. The roofs of both reservoirs are constructed with 9-inch brick arches, asphalted over, and covered up level with earth.

Water Resources.—The present resources of Widnes as regards its water supply, if all three stations were worked to their maximum capacity, are estimated at 3000 million gallons per annum—a quantity sufficient to supply a town of 260,000 inhabitants with 30 gallons per head per diem.

Water Charges.—The selling price of water by meter for manufacturing purposes is 4½d., 3½d., and 2d. per 1000 gallons net for varying quantities. The net charge for domestic purposes is 4½ and 4¾ per cent. on the rateable value, inclusive of baths and water-closets.

Water-Works Capital.—The total capital expended on the water-works, including the original purchase-money, up to the 25th of March last, was £175,069, of which £11,988 has been paid off through the sinking fund and the profit and loss account; leaving the actual indebtedness £163,081.

* See "JOURNAL," Vol. LXII., p. 227.

NORTH OF IRELAND ASSOCIATION OF GAS MANAGERS.

The Annual Meeting at Holywood.

We conclude to-day our report of the proceedings at the above meeting, by giving the conversational discussion which took place on the subject of

LOSS BY LEAKAGE, OR UNACCOUNTED-FOR GAS.

Mr. P. J. SALMON (Galway), who originated the discussion, said that it was at first his intention to prepare a paper for the meeting; but he had had considerable sickness in his family, and could not accomplish it. He would therefore content himself with bringing the subject before them, so that it might, in future, be the means of providing matter for a paper for someone. They all liked to find out the difference between the make of gas per ton of coal, and what they got paid for. He was, unfortunately, badly situated in this respect. He had about twelve miles of main, the largest of which—12 inches—was not a quarter of a mile in length; and the remainder, upon which there were about 200 consumers, were of 4, 3, and 2 inches diameter. In the case of the small mains, they had to force about 30-10ths so as to get a good result at the other end; and the consequence was that consumers grumbled that they had not got the illuminating power—as was spoken to by Mr. Cummings in connection with another paper. He went into the subject of loss by leakage; and he found that, as a general rule, small mains were a great loss to gas undertakings. But their greatest loss by leakage was in the service-pipes. Two months ago he started to test a main; and he discovered one small service making away with 12 cubic feet of gas per hour, while another was losing 10 feet per hour. One of these, he was told, had been down for 60 years. Previous to his going to Galway, they had a fashion of lifting a 30-year old main, putting it into a side street, and then calling it a new main. Last month he found that the joints, which had been put in with portland cement, were still perfectly good. The services, as a general rule, had "gone" in the channel, just where the water passed over them. When Mr. Gibb was in Galway, before him, he put down oxidized services; and these he found to be as good as when they were laid, everywhere except in the channel. The question for them was to get over this difficulty, either by laying the pipes in a bed of concrete across the channel, or otherwise. He believed that a great deal of gas was lost in the course of laying mains and services. Sometimes when a man was half way through with a pipe, he wanted to go and get a chisel, or something of that kind, and a piece of cork was stuck into the hole; but a great deal of gas escaped in the meantime. Then, as to the prepayment meter. It was very well if they got people to sign an agreement; but after some time, they occasionally found a penny in the box for a whole month. One gentleman was so kind to them that he had not even a penny in the box at the end of the month. This was a matter they could not account for. If they got a consumer to sign to pay according to the ordinary index, and not by the penny-in-the-slot, he thought that it would be of great service to them.

The PRESIDENT (Mr. T. Frizelle) said this was a very interesting subject. Like the poor, it was always with them. Mr. Salmo-

had had his difficulties, and had told them something of the way to overcome them. He would like to hear how some of the rest of them got over the same troubles. In Holywood, they had very heavy leakage at one time—as high as 25 per cent. It was down now to between 9 and 10 per cent.; and there was a lot of labour in bringing it down to that. He found that the service-pipes were not so much corroded, but that bad joints had been made on the leading mains. For 15 or 16 of the public lamps just outside the works, every joint on the leading main was leaking; having in some instances drawn ¾ inch. They supplied a country district about three miles out from Holywood; and a great number of the joints connected with this supply were drawn. They were obliged to go along and test almost every joint. They were taking as much gas as they could out of the coal in the retort-house; but it was going off into the air, and was not finding its way through the consumers' meters.

Mr. SALMON said there was no use in keeping back anything at all. Their make was 17 million cubic feet; and of this they lost 4 millions. A loss of 4 millions meant the spending of a little money to stop it.

Mr. G. CUMMINGS (Ballymoney) said he had had a great deal of difficulty with this subject. He had taken out services which had been 40 years in the ground; and in some places he had found that, although the people were getting gas, the services were gone entirely for a length of from 6 to 9 inches—there was no pipe whatever. He had two different sorts of soils to contend with; the one of boggy matter—in fact, common peat—and the other, red clay. The peat consumed the pipe entirely away, while there was nothing the matter with it in the clay. He could only account for it by the peat eating away the iron. He tried to prevent this by putting in galvanized iron pipes. There had not been time yet to prove whether or not this had been effectual. He also found that a great deal of leakage occurred on account of the way in which the connections had been made with the mains. Many of the connections were of block tin; and, under certain conditions, they did not last well. On one occasion, on striking a match over a pipe, a pure gas-flame burned at the surface; and about 3 ft. 6 in. from the pipe there was a flame of about 2½ inches. The joints had been drawn in the boggy matter.

Mr. W. MILLER (Cookstown) said he had considerable difficulty with service-pipes. He had one in his mind's eye, which supplied a chapel. He stripped 20 or 30 of the joints; and he believed they were not all leaking. The ground had been disturbed. Very often services did not leak until they had been disturbed. In all cases now they put in steam-pipe, which was somewhat harder to work; and they made a kind of V in which they laid it in tar and sand, which formed a sort of concrete round the pipe. They had done this for three years; and when they came across any such pipes, they found that there was not a mark on them.

Mr. R. ROSS (Dungannon) found that the services, as a rule, if they were not disturbed, were perfectly tight; but that, if they touched them at all, they were gone. They were not very bad where he was; but they had some pipes cracked by the frost. With regard to penny-in-the-slot meters, the idea was that they were for the benefit of the gas consumer; but they were also for the benefit of the gas supplier.

The HON. SECRETARY (Mr. J. Whimster, of Armagh) said that the discussion seemed to have so far gone on the presumption that unaccounted-for gas arose from defective mains and service-pipes. This was not his opinion at all. Defective mains and service-pipes had something to do with it, doubtless; and probably in some of the instances they had heard of, they had had a great deal to do with it. When they heard of the soil subsiding, and joints being drawn to the extent of ¾ inch, there must be some leakage; but as a general rule, with mains and services well laid, he did not think there should be much leakage from them. One reason for this was as Mr. Cummings had pointed out. He (Mr. Whimster) had come upon services—or rather had gone into the ground where there should have been services—and had found none, but simply a hole in the ground. Yet there was no gas escape. The people might be complaining of want of gas, and when they uncoupled the meter, they might find that there was a deficiency in the supply; and, of course, an order would then be given for a new service to be put in. When the men went down, for perhaps 18 inches of the length of the pipe, they would find that there was no pipe; but as the soil was stiff clay, there would be no escape of gas from it. There would be no escape from such soil unless it was disturbed. He was now busy renewing a main; and he had had some difficulty with an escape which they could not locate. The main had been broken by a steam-roller. He found one break when he opened the ground, and thought he had cured it; but the smell came as badly as ever. He thought his only safe course was just to follow the pipe up; and on the previous Saturday he came upon the proper place—the main broken across in two places within about a couple of feet of each other, and very close to a service. He meant to go a little further still, so as to make perfectly certain he had got to the end of the trouble. It was his experience that where there was an escape, it would make itself felt, and they would be bound to seek it out. Leakage from mains and services during repairs was, he considered, a very small matter. They might just fancy how much it would be if they were laying a 4-inch main—only a few hundred feet. He thought it was a kind of fallacy to hold that it arose from mains and service-pipes. His own opinion was that a good deal of it came from two sources. One was wet meters. He was a great advocate of wet meters; but still they were a source of loss to gas companies. With wet meters the limit of variation was 2 per cent. fast and 3 per cent. slow. So 2 per cent. was the most they could get out of it when the water was at its highest level. But how long did a meter stop with the water at its highest level? The normal condition was that the water was at its lowest level, and the float a bit stiff. It was in this way that they lost a great deal of their gas. The other cause was the difference of temperature. In the town where he lived, where the bulk of the consumption was in shops and large institutions, the meters were usually in outhouses or underground cellars—the coldest places possible. In shops, they were often somewhere about the door, which was usually standing open all day long, and was at the same temperature as the outside atmosphere. So that during winter their gas was measured at the lowest temperature possible; while in the gas-works it was measured at a higher temperature. He considered, therefore, that they lost quite 5 per cent. of the gas during winter through difference in temperature; and he should say that they lost somewhere about 3 per cent., on a fair average, through wet meters—taking the year round. He did not think that any attention to mains and services would remedy this state of things; and they must just put up with it. It was right to attend to mains and service-pipes, and to make them as tight as they possibly could be. It was his custom when he was ordering mains and services to get the heaviest make of pipe; and he also always put in steam-tube services coated with red lead. As for prepayment meters, his experience with them, for three or four years, was that there was not much loss from them. He had only had one serious experience of loss with them. The first few meters he obtained were splendid. They were working yet, and had never given any cause for complaint. After that, however, he got some more; and they really did give him dissatisfaction. Several of them were very troublesome. In one instance, they lost something like 6000 or 7000 cubic feet of gas through one consumer. He changed that consumer's meter once, and put in one which had been working satisfactorily in another place, and which he had tested and found to be satisfactory. Yet, somehow or other, that consumer managed to get the gas without the proper number of pence being put in. He (Mr. Whimster) did not know how he managed it; but it was done somehow. He just quietly turned off that consumer's supply, but he had since given him gas by an ordinary meter, on paying a deposit. He would not give it to him under any other condition. Taking the year round, he found that prepayment meters went a little the other way—that he was paid for a little more gas than was consumed, rather more than the loss. They gave 22½ cubic feet for a penny. Public lamps, he thought, were a source of loss to them. He did not think they were paid for all the gas which was used in the public lamps; but then he considered that they were under some debt to the public—they opened up their streets and the like; and if they lost gas in this way, they could not help it. The unmetered lamps burned more than the metered ones. In frost, also, there were always some of the metered lamps going out. He never took any notice of these things unless a lamp had been out for a very long time; and then he struck it out of the average altogether.

Mr. D. WILLIAMSON (Clones) said his experience accorded with that of Mr. Salmon in regard to mains and services. When new water-pipes were being laid, he came in contact with many pipes of his which he would not have seen for some time, and which were in bad condition. He entirely agreed with Mr. Whimster's remarks about wet meters; but they could look after them, while they could not always look after service-pipes. Perhaps the great defect was that they did not renew their services after a number of years.

Mr. R. S. CARLOW (Arbroath) said the question of leakage was a vexed one; but it could be put under four heads. The first was meters; the second was public lamps; the third was mains; and the fourth was services. If they were careful with the watering of their meters, and seeing that they were always kept in proper order, there was no doubt that a large saving would be effected in this way. There was something also in the temperature, as spoken to by Mr. Whimster. Then as to mains, if they were living in a place where there were underground workings, there would be very considerable leakage; and if they had not a careful man looking after the mains, they were bound to have large leakage. In his own case, he found a very large number of old wet meters. They tested them; and in some instances they were going as much as 10 per cent. slow. The consequence was that, as they were losing so much, they had them all destroyed—hundreds of them. When he went to Arbroath the leakage was 16 or 17 per cent.; but last year it was only a little over 7 per cent. Public lamps were a source of loss. He put a number of meters on public lamps at different levels in the town, and ascertained what the lamps were actually burning. He then fitted up some Peebles No. 1 governor burners consuming 3 cubic feet of gas per hour, and at the corners of the streets burners consuming 5 cubic feet per hour. He had his governors placed immediately alongside the meters; and he found, when he compared the meters with the governors, that he got practically the same results. The Superintendent of Police kept a note of how many hours the

lamps were lighted; and they got payment at "per hour." Mr. Whimster said something about the low level of water in the meters; but he (Mr. Carlow) did not think there was such a great deal of loss thus occasioned, because they all knew when they had careful men. Then as to service-pipes, he found that, with malleable iron tubes, there was always great leakage. In his case, they had been re-causewaying a large number of streets. Whenever he found that streets were to be re-causewayed, or other improvements made, he put on a squad of men, and had every service-pipe in the street examined. He did not use malleable tubes at all. He used lead pipes; and he was very careful to make good connections. He considered he was doing what was correct, and that he had thereby prevented a large amount of leakage.

Mr. A. GIBB (Newry) pointed out that percentages might be exceedingly deceiving, inasmuch as they might be sending more gas through their pipes while large leakage was going on. It was not a true term. One source of leakage which had not been taken into consideration was the temperature of the gas at the station meter, and the level of the water in the station meter. In provincial towns, they had not all the appliances which they had in larger towns. It might be that the exhauster was being driven too quick, and the water got out of level, and a very great difference might exist there, which must also affect the leakage or unaccounted-for gas. He thought that the members generally had taken up all the other points; but these were two which, it occurred to him, had not been mentioned.

The PRESIDENT considered the discussion had been a most interesting one. Time was, however, pressing, unfortunately; and they could not continue the discussion further.

BRITISH ASSOCIATION OF WATER-WORKS ENGINEERS.

To-day we conclude our report of the proceedings at the first annual meeting of the above Association by dealing with the three papers bearing on matters coming within the department of water distribution. The papers (which are here abbreviated) were discussed together.

Mr. R. E. W. BERRINGTON (Wolverhampton) read the first paper. It was entitled—

THE USE AND MISUSE OF WATER.

The author first deals with the false idea that driblets of water from taps can have a cleansing effect upon drains; but he points out that a thousand taps left open for this purpose would have a material effect upon the water supply of a town. He then alludes to the difficulty of fixing the quantity of water required per head, seeing that so many factors (some of which he enumerates) enter into the consideration of the question. Meter readings show the consumption of water in cottages to vary from 4 to 7 gallons per head; in larger houses, from 7 to 16 gallons; while in houses with two water-closets it often comes under 20 gallons. The author holds that, under strict supervision, an efficient supply for domestic purposes may be given with 10 to 15 gallons per head.

The amount of water going to waste in the course of a year in this country must be enormous; and if a monetary value were placed upon it, we should, Mr. Berrington declares, view such waste as a "national calamity." A good percentage of the waste occurs underground; and therefore its tendency is to produce damp subsoils, wet basements, and ill-health. In colliery districts mains are subject to sudden subsidences; and although a special form of joint has been adopted, it is not always successful. Service-pipes should be laid sufficiently deep to protect them from frost, and in doubtful ground should be surrounded with a soil known to be harmless to such pipes. A frequent source of waste arises from defective ball-taps; and as there are hundreds of overflows which still communicate with the drainage system by unseen channels, it is only by careful inspection that these leakages are discovered. Much waste often results from the ball-tap being insufficiently fastened down; and as the water in the cistern rises, it lifts the ball-tap, and the water passes down the overflow for hours together. Of course, this could not happen in a properly-fitted modern cistern. As to the future discharging capacity of water-closet cisterns, given a well-laid drain, a properly-made closet basin, a cistern not less than 5 feet or 6 feet above the basin, a down-pipe of not less than 1¼ inches diameter, then, in the author's opinion, a 2-gallon flush will effectually do the work; but the work will be much better accomplished with some basins than with others. He believes, however, that a 3-gallon flush will ultimately become general, because in sanitary matters nothing short of absolute certainty and entire reliability is acceptable. Speaking of severe frosts, he condemns the practice of shutting off the water or reducing the pressure considerably at nights. This, he believes, is the cause of much injury to the local authority or company as well as to the consumers, and is a retrograde step in the matter of public health. There can be no doubt that taps in open courts or other exposed positions cause endless worry. But the tendency now is to provide a tap for each house; and if care be exercised in laying the service, and if the consumer be taught to see that—at all events where the works are the property of the local authority—he is an interested party, good results may be expected. Even in a severe winter, with a judicious use of stop-taps and gas-jets, one can nearly, if not quite, get through without a burst pipe.

In the detection of waste, the author remarks that the value of waste-water meters is beyond question. Systematic house-to-house inspection, followed up by the plumbers, is also very effective. Some years ago, he undertook an inspection of this kind in a large town; and the consumption was reduced by 3 gallons per head as a consequence, from one inspection. The introduction of the Deacon meter has, in several instances, reduced the consumption 50 per cent.; and it would more than justify its use in reducing the consumption by 20 per cent. in any ordinary-sized town. In new works it is easy to arrange for the waste-meter system; and it is desirable to make such provision. He also insists that the insertion of a stop-tap on each service should be looked upon as a *sine quâ non*. The water engineer manages his works as well for a company as for a corporation; but the author supposes there will be a consensus of opinion that the supply of such an essential as pure water should be in the hands of the local authority. It is a question as to whether the water and sanitary arrangements of the household should be under the immediate control and actually maintained by the local authority—first, on the score of public health, and next in order to secure efficiency and economy in those works in which the general community has a direct interest. The competition among plumbers, and the desire of householders to get the work done cheaply, lead to the use of much inferior material and bad workmanship; and this often means disease and deteriorated health, if not death. Under the Public Health Acts, the local authority exercise certain powers with regard to house drainage; and there is a limited control over the strengths of lead pipe, taps, &c. But from an engineering or sanitarian point of view, the control does not go far enough; and as a matter of fact a house may be built in any large town in this country and the sanitary arrangements pass the usual inspection, yet upon examination a terrible state of things might exist. The author does not wish to undervalue the great progress being made; but he speaks from an intimate acquaintance with this particular branch of work, and from dozens of cases which have come to his knowledge during the last ten years or so. Is it, he asks, desirable to repair water-fittings at actual cost price? and, should winter bursts be repaired at cost price? Many authorities washer taps free; and no doubt it pays to do so. It has been suggested that every house should be supplied by meter; but this would involve a capital outlay of several millions sterling, besides a good round sum yearly for maintenance. The author does not believe in a metered system. The very poor require to be taught to use, not stint, the water. If we are to secure a healthy community, its individuals must be kept healthy; and to be healthy, one must be clean. There are disease centres in every town; and we need to cleanse them. If possible, the very origination or the development of the germ of disease itself must be prevented. The water engineer can do much in this way, and is doing much now. If water had to be paid for by meter instead of by a rate, we should get people going without their bath to save the money. Money-making is a disease with certain individuals; and there are hundreds of people who put up with a most insanitary appliance rather than pay the water-rate for a proper closet. The water-rate, therefore, should be such as will include the water for a closet or two, according to rental.

The concluding part of the paper is devoted to a *resumé* of the foregoing, with a few additional suggestions—among them being: That in every water-works a system of stamping fittings should be in operation; and samples of approved fittings should be exhibited. That mains should be laid with not less than 2 ft. 6 in. or 3 ft. cover; and that they should be tested before being covered up. That reliable self-closing taps may be introduced with advantage in many cases, and without the concussion that used to be experienced with the old type of tap. That economy in water will often effect a saving in capital expenditure, annual working expenses, and wear and tear of machinery. In the following table, the author shows that the quantity of water which escapes through small apertures is enormous; the figures being actual results of experiments made by him:—

Description of Fitting under Test.	Gallons Wasted in 24 Hours.
½-inch bib-tap, washer bad	700
⅜-inch tap, washer bad	920
¾-inch tap, screw stripped	12,720
⅜-inch ball-tap, washer bad	900
⅜-inch ball-tap, lever strained	200
Pipes burst by frost, ¾ inch	11,280
" " " ½ inch	17,280
Taps left open, ¾ inch	23,520
" " ½ inch	12,000
" " ⅜ inch	9,600

Mr. J. SHAW (Boston) next dealt with

SOME CAUSES OF FAILURE IN SERVICE MAINS AND PIPES.

Passing over the first part of this paper, in which the author refers to the predecessors of present-day water mains and services, we come to the declaration that failures in service-pipes are the bane of the resident engineer's existence. In average works probably nine-tenths of the total waste, Mr. Shaw says, may be debited to their account; and, as such waste often finds its way into a sewer, it is difficult to detect.

The scientific design of a service-main does not seem to enter into the consideration of the engineer to-day so much as it did fifty years ago. Although the discharge with a given head is well understood, they are rarely enlarged on a flat, and diminished on a steep gradient; and more rarely still increased or diminished in thickness as the pressure to which they are exposed is greater or less. The reason of this, he remarks, is not far to seek. With many foundries, cast-iron pipes have become specialties; standard sizes, lengths, and weights being cast suitable for any ordinary pressure in water-works practice. The requirements of enough metal on the pipes to take a thread for the insertion of ferrules, and to resist the transverse strains of earth movements and heavy traffic—even when the times of traction-engines and steam-rollers had not yet come—probably had more to do with the standard thickness of cast-iron mains than any fear of their inability to withstand the pressures. No standard iron main well cast, of good material, and free from flaws, has given way from weakness in design; and yet every year cases come under notice of failures of pipes—some apparently sound, others with flaws more or less easily traced. The author alludes to the strict inspection to which pipes are subjected at the foundries. "Specials" from local foundries are described as being often indifferent; "double collars," curiously enough, in the author's experience, providing the greatest number of failures. The branch-pipe, which is a combination of an angle, tee, and bend, is occasionally a trouble from moving of the core.

Coming to joints, Mr. Shaw says the spigot and socket joint is the favourite; and, fairly made, this will stand any pressure likely to be found on water undertakings—indeed, they have been used on hydraulic mains. But above 500 lbs. the lead has a tendency to work out. In mains laid by contract, and insufficiently inspected, it is sometimes found that the bulks of lead and yarn have changed places; the pouch being mainly filled with yarn, which forms the nucleus of future troubles. Turned and bored joints are favourites with some engineers, and have the merit of being quickly and easily made. They have the disadvantage, however, of being inflexible; and therefore unsuitable for slight changes in level and direction, as well as expansion and contraction where there are extreme variations of temperature. Joints on "Foster's" principle are splendid for temporary pipes; but the variable life of india-rubber makes this a somewhat questionable joint for water-mains. On the Boston works, the service-mains from the reservoir to the town (12 inches in diameter) are jointed for 12 miles in length with wood wedges driven into the socket in place of lead; and, although they have been in use nearly fifty years, they have not cost a sovereign in repairs, and to all appearance will stand another fifty years.

Referring to damage to pipes by violence, the author mentions the drawing of joints and breakage of mains in localities where mining operations are carried on. Then extraordinary traffic—such as traction-engines and steam-rollers—plays havoc with small service-mains; and labourers opening out a trench for gas-pipes or sewers have the wonderful faculty of driving their picks through a water-pipe. But the loss occasioned by all these causes put together is insignificant when compared with that produced by the almost annual advent of frosty weather. The damage caused by water actually freezing in and bursting the pipes is, as a rule, confined to consumers' services. Some engineers experience another kind of failure, indirectly caused by frost. Instead of a longitudinal split, the pipe breaks across. The time of breakage varies—in some works, being confined to the time of severe frost; in others, it occurs sometimes at the time of the frost, but generally fifteen to twenty-one days after the thaw. The smaller-sized mains are the ones most affected. The composition of the subsoil seems to be the principal factor; but the temperature of the atmosphere and water in the main are also considerable factors. In Boston, up to January, 1891, these breakages invariably happened about a fortnight after the thaw. But in that year the reservoir, being unusually low, the breakages occurred during the prevalence of the frost, and reached the maximum of any recorded; while in January, 1895, with all the terrible weather, the breakages from this cause were far below the average. Observations have shown that with snow on the ground, and a fairly full storage reservoir, the temperature of the water in the service-tank, even when it and the filters were covered with ice, did not fall below 36° Fahr., which increased 3° and 4° on its way to the town. After the thaw, the melted snow brought the water to nearly freezing-point; the temperature in the town mains falling to 33°, at which point the subsoil was probably affected, and, moving, caused the fracture. In January, 1891, a long drought and frost having practically emptied the reservoir, the water left fell rapidly in temperature, and after a month's frost the low temperature was noted in the town. But in 1895, the storage reservoir was full; and, with an absence of snow, the temperature in the main did not fall below 36°. Breakage of mains from water ram and hammer is also much more frequent than is generally supposed. The abolition of the old plug-tap removed one source of concussion; but the ordinary self-closing "push" valve so much in evidence at drinking-fountains will, especially at high pressure, put a very undesirable strain on pipes. Within his knowledge, too, hydraulic organ blowers, working with a head not exceeding 100 feet, and probably much less, burst a connection which for days had stood the test-pressure of 550 lbs. to the square inch. Unbalanced ball and relief valves are also sinners in this respect; and the sudden opening of a sluice-valve admitting water to a district, especially where services are few, is sometimes the cause of a leak from the shifting of the lead in the joints.

Corrosion and incrustation are the next failures mentioned. As a general rule, soft surface waters, flowing from drainage areas, corrode and incrust the main by oxidation, diminishing both their strength and waterway; while hard waters derived from springs in a limestone district incrust by depositing crystals of lime. But soft waters are found which incrust, but do not oxidize, and hard waters which oxidize but do not deposit lime crystals. The same water will have no effect on one particular part of the main while it attacks another. On one pipe coated with Dr. Angus Smith's composition, the interior was found, twenty-five years after, as bright as when it was dipped; while in the case of another, a few hundred yards away, the water had, in one-tenth the time, dissolved the solution, and great wart-like carbuncles of iron oxide had formed on the interior. What is the cause of this anomaly? Analysis of the rusty deposit shows it to consist mainly of ferric oxide, with some matter of vegetable origin, while calcareous deposits are chiefly calcium carbonate. The ordinary rusting of iron, so familiar to all, depends on something more than exposure to an atmosphere containing oxygen; for specimens of iron broken to show the fracture keep their brightness in some situations for years. The presence of other substances—notably ammonia and carbonic acid gas—seems necessary for the oxidation of iron, and, under certain circumstances, this action is greatly intensified. Coating with Dr. Angus Smith's solution does not always protect the main, this composition being soluble with some waters when they attain a temperature over 55° Fahr., giving the water a strong pitchy taste. Mains rising to a dead end are more liable to this form of incrustation than those laid on a falling gradient; and the quantity of water passed through the pipe has also some influence on this form of incrustation—those through which little water passes being more liable to choke than where a large quantity is regularly delivered.

As a last cause of failure, the corrosion of cast-iron mains from the outside is referred to—an experience happily of a somewhat local nature. Inquiry generally shows that in the case of speedy deterioration of mains, this generally occurs in new districts where the streets have had to be made up with refuse from chemical works, containing sulphur or chlorine, which develop acid properties attacking the iron. The same effect may take place more gradually, but not the less surely, in other places often away from towns and chemical works. Even in ordinary made ground in towns, especially where the sewerage system is or has been defective, mains laid near sewers will suffer; the sulphuretted hydrogen and chlorides in the soil being probably the cause of the defect. An instance of this action occurring away from such surroundings is found in the main at present supplying Boston with water, which has already been alluded to as being jointed for 12 miles with wooden wedges. The main was laid in 1847-48, at a time when the railway mania had rendered money scarce and iron dear. Therefore it was cast somewhat light as compared with present-day practice. For nearly the whole of its length, it is laid through alluvial deposits overlying the boulder clay; and, at two points, it approaches a layer of peat, which lies at a variable depth over almost the whole of the fens. Within these two districts, about three miles apart, nearly all the bursts on this main have occurred within a distance of 400 yards or so, possibly averaging one per annum. The subsoil water at this point is very brackish; and the chlorides may assist the peat in dissolving the iron.

As regards consumers' lead and wrought-iron services, some of the lead pipes of the present day are hard, and break with a crystalline fracture on any attempt being made to bend them. Steel gives great promise. Its tensile strength is well known; but its behaviour under conditions where it is liable to corrosion have not yet been put to the test sufficiently long to satisfy all that it is the most desirable material for this purpose. A cast-iron pipe made of a white, hard pig in which the crystals are small seems to be the strongest and at the same time the material which resists corrosion best, although more liable to crack if carelessly thrown down. According to the size of main and nature of the roadway, the trench should be deep enough to leave from 2 ft. 6 in. to 3 ft. 6 in. of cover on the top of the main; small pipes requiring the maximum. If unaccompanied by snow, frost will go down under a pavement to a depth of 3 ft. 6 in. On a macadamized road it does not descend so far; on gravelled footpaths, it descends still less; and on ploughed land, it descends a very few inches. Heat in the summer months will descend to a far greater depth than cold in the winter months; and the temperature of the water at consumers' taps is more affected thereby.

The paper closes with some additional practical hints—for example, service-mains should be well provided with stop-valves; unbalanced ball-valves and other apparatus causing concussion when closing should be interdicted; all sluice-valves and fire-hydrants should be closed gently; frequent scouring at the ends is the best preventive of incrustation; and where the distance between the service reservoir and the town exceeds two or three miles, a duplicate main, capable of conveying 60 per cent. of the maximum supply, should be laid, with no connection on it until it reaches the centre of distribution.

Mr. Oscar J. Kirby (Batley) submitted the final paper of the series. It was entitled—

WASTE OF WATER IN ITS RELATION TO LEAD SERVICE-PIPES: LEAD-POISONING.

In his opening remark, the author informs us that it is real lead pipe which he intends to refer to—*i.e.*, pipe milled from English pig lead, and not from scrap lead. Lead used in the manufacture of water-piping should, he holds, be free from every impurity but one—viz., silver, as this impurity renders it more proof against the action of acids which may come in contact with it. Corrosion of lead pipes from the outside, and the waste of water in consequence, can be guarded against; but the corrosion of lead pipes from the inside is quite a different matter. Samples attacked in this way (shown) were corroded all through the length, and in such cases a fracture may occur at any point or at many points. Soft moorland waters which contain acid produced by decaying peat, act upon lead in this manner. But if peat and other decaying vegetable matter are kept out of the impounding reservoirs, the acid is not produced; and, as a consequence, lead pipes are not acted upon.

Waste of water resulting from its being acidulated and dissolving the lead services—causing them to burst frequently—is a matter of serious moment both from the suppliers' and the consumers' point of view. The law was set in motion many years ago by consumers who sued certain undertakers for damages in consequence of the consumers being injuriously affected—viz., by being lead-poisoned; but, inasmuch as the water was delivered free from any lead contamination into the consumers' service-pipes, the undertakers were held to be free from any liability. In this connection, it is, remarks the author, worthy of note that, where litigation first began, there had not been any attempt to keep the peat out of the reservoirs, neither could the top water be drawn from the impounding reservoirs; the arrangement of the valve-shafts being such that no water could be drawn from the reservoirs except at the bottom. This regrettable arrangement still exists—the most acidulated water being continually drawn off for consumption; and the purer water, which is subject to the action of the air, on the surface cannot be utilized until it has been fully acidulated.

Many corporations, the author points out, are now treating their water supplies with calcium carbonate to neutralize the acid produced by the decay of peat in the impounding reservoirs; and much waste of water is thus prevented, inasmuch as the lead-services are not washed away, and burst by the action of the water upon them. When service-pipes are composed of English lead from which the chief impurity—viz., silver—has not been separated by cupellation or fulguration, they resist the action of peat acid. The author has examined lead pipes which have been in constant use for thirty years, whose calibre and weight have been precisely the same when taken out as when they were put in; thus proving that no portion of the pipes had been washed away by acidulated moorland water—or, in other words, the water had no action upon them. As a substitute for good argentiferous lead, the pipes are frequently lined with tin about a millimetre in thickness; but, in the production of tin-lined lead pipe, the tin dissolves a considerable quantity of lead, consequently the lining is not pure tin, but a mixture of tin and lead. Hence the reason that acidulated water drawn through these pipes, and subjected to the sulphuretted hydrogen test, distinctly indicates the presence of lead. As tin melts at a much lower temperature than is required for solder used by plumbers to make the joints in the pipes, it runs and fills the invert of the pipes, leaving them weak at the joints and partially filled up with tin. This accounts for the fact that these pipes so frequently burst near the joints. Of course, they can be joined together with gun-metal cone connections without the aid of solder; but inasmuch as the lining is an alloy of tin and lead, it does not effect the purpose it is intended to. Tin-washed lead pipe has proved itself to be superior to tin-lined lead pipe; the process of washing being done so quickly that there is not time for the tin to dissolve the lead. In jointing these pipes, the ends to be joined should be filled for a few inches with table salt so as to prevent the tin-wash running when heated by the plumber's solder. The salt can easily be washed out of the pipes after the joints are made. Acidulated water drawn through these pipes does not yield the slightest trace of lead contamination.

Some particulars as to two cases of death which were wrongly attributed to lead-poisoning through the water supplies are given by the author, who, concluding his communication, says: When the general public get hold of the idea that, by allowing their water-taps to remain open, their health will be improved, the water-works engineer and his committee have both a busy and a disagreeable task to perform in convincing them to the contrary. In Batley, waste of water, as the result of this false notion, has caused a loss of nearly £6000 a year; and nothing would deter the delinquents but suing them for the usual penalties. It is satisfactory to note that of the wholesale prosecutions which have taken place, not one case has, so far, been lost; and a remarkable coincidence in connection with it is that the present death-rate is 3 per 1000 less than when fabulous quantities of water were poured down the sewers to be pumped at the sewage-works. The present domestic consumption is less than 12 gallons per head per diem. There are two systems of mains in the borough—one for the domestic supply, and the other for trade purposes. District meters are fixed to both systems.

Discussion.

In opening the discussion on the three papers,

The President (Mr. D. M. F. Gaskin) first of all referred to a sample of the old wooden pipes which were used in Ipswich in 1401, and which had been sent him by Mr. H. Roberts, the Engineer of the water-works in that town, for exhibition at the meeting. As to the allusion in Mr. Shaw's paper to extraordinary traffic fracturing pipes and services, the President said there was another thing steam-rollers were responsible for. Very often in passing over macadam roads, they shifted the hydrant covers; and, in time of fire, the cover was frequently found fixed over the spindle. The men, too, seemed to have a particular fondness for resting the steam-rollers on the tops of hydrant boxes; and the weight, being transmitted to the pipes, broke them. Regarding the 2 and 3 gallon flush for closets, he agreed with Mr. Berrington that the former was effectual with proper fittings. Respecting taps in open courts, these were an endless worry no doubt; but the difficulty was to get them transferred into the houses. Very often in the class of property supplied by these taps, they had no sink-stones; and so the taps in many courts remained on the outside. They were a source of waste; but it was a waste distributed over twenty or thirty houses. He strongly condemned the great waste that occurred in numbers of houses where people of education lived. Passing to Mr. Kirby's paper, he remarked that it was a valuable contribution to the subject of lead-poisoning, and pointed out that engineers who had to deal with hard water had to take out the lime, while those who supplied moorland water had to add lime.

Mr. W. Watts (Oldham), alluding to the temperature of water, said that for three years, under the instructions of a Committee of the British Association, he took readings of a number of important reservoirs; and the results appeared in the proceedings of the Association some two or three years ago. The difference in the temperature of the water compared with the air was very remarkable. The water 12 inches below the surface varied from 62° in summer to 34° and 36° in winter. That was a very important matter. He found, too, that when the water got over the temperature of 54°, the animalculæ in the water began to develop very considerably; but when the temperature reached about 60° to 62°, it was most singular, the animalculæ did not develop to the same extent—more particularly the cyclops. With regard to the loss of water, they did not use Deacon's waste-water meters extensively in Oldham—for the reason that they had meters at the head of the works, and measured all the water flowing from their drainage area. Punctually every morning these meters were read; and if they had an idea that there was excessive loss going on, they stationed men in the meter-house for two or three nights, to take records every fifteen minutes; so that at any particular time of the night they knew what amount of water was being wasted, and acted accordingly next day. With regard to coating pipes by Dr. Angus Smith's process, that was not altogether an infallible cure for rust. They had some old reservoirs built in 1837-8—nearly sixty years ago—and the pipes connected with them were as perfectly sound to-day as they were when Dr. Angus Smith's coating was unknown. In regard to the Oldham drainage area, it consisted of about 6000 acres, and was mainly peat. Moorland water was about the best water they could have if it was dealt with effectually. In times of extraordinary floods, they passed the flood water into the compensation reservoirs, which were invariably at the bottom end of the works. Then they had a number of residuum lodges, into which they put the better quality; and it was freed from the peaty water, which caused the action upon lead-piping. In order to have as little polluted, dirty water as possible, they were roughly pitching all the ravines from the inlet of the highest reservoir to the top of the moorland. In some cases they were making trenches in the peat, with the view of getting the water to flow from it more quickly. Under conditions of this kind, there must be ample storage; and this they had at Oldham. Being in such a favourable position, they were able to keep the water for a considerable time for bleaching. There was nothing that purified moorland water more effectually than exposure to light and sun heat.

Mr. H. Ashton Hill (South Staffordshire Water Company), alluding to the quantity of water required for domestic purposes, said, of course, that depended very much upon the character of the population. With regard to the 2 and 3 gallon flush question, before settling upon the 3 gallons, they should get all water-closet fittings abolished which were not in accordance with the best type. Remove the fault; and then the 2 gallon flush would be right. Towards the close of the paper by Mr. Berrington, reference was made to the ownership of water undertakings by corporations and companies. That would be a subject for great debate; and he thought one point in it would be that they, as engineers, could do better for companies than for local authorities. He maintained that, from his experience, the man who was responsible, and on whom the success of an undertaking depended, could not do the best that was in him under a corporation, as was possible under a company. As to the depth of mains, he had, from investigations, concluded that, to prevent damage by frost, 2 ft. 6 in. was the proper

depth to the top of the pipe; and at that depth they also overcame all difficulties with steam-rollers. In cases where pipes crossed bridges, last winter he adopted the measure of coating them. On the same principle that boiler composition was put on steam-pipes to keep in the heat, they put composition on the water-pipes to keep in the heat also—to prevent conduction. As to the adoption of reducing-valves, he had been considering the question of introducing them in certain places where water was distributed at 185 lbs. pressure. He had put one in; and it was acting satisfactorily. Concerning turned and bored joints, he mentioned that, when occupying the dual capacity of gas and water engineer a few years ago, he used both kinds of pipes—ordinary lead joints for water-mains and turned and bored for gas-mains. He conceived the notion of simplifying his stock; and instead of keeping two kinds, and having the book-keeping to contend with, he adopted turned and bored joints for both gas and water, with satisfactory results. A large portion of the area of the Company with which he was now connected was a colliery district; and they were subject to breakage, so that the turned and bored joints were, of course, out of the question.

Mr. W. G. PEIRCE (Richmond) inquired whether Mr. Berrington did not consider the use of filtered and even softened water on the public roads and for sewer flushing a misuse. At Richmond where water was scarce and valuable, he was compelled to adopt a separate system—that was, a length of water-pipe (it need not be large) along the main streets, at convenient places for the Borough Surveyor to draw water from for the roads and sewer flushing. Of course, a separate system of this kind was only possible in places in close proximity to a river or the sea. At Richmond, he first put up a small engine, and pumped water from the River Thames. The system had been gradually extended, until they had almost covered the town; and now they had two engines, and were contemplating having one of the Worthington type, capable of pumping 600 gallons per minute. They had found this system of great use in helping them through the drought. In his town, all the cottages had water-closets; and they did not charge for them or baths. With reference to the question of the 2 or 3 gallon flush, in his opinion the former was adequate, providing the down-pipe was sufficient in capacity. He spoke favourably of the waste-water meter system. As to the universal use of meters for domestic supplies, he said that, if he had a meter to every house, he believed the consumption in his town would be reduced by one-half; but he feared there would be little water used for flushing. Their consumption averaged in the past year 27 gallons per head; and deducting trade supplies, sewer flushing, road watering, and other outside purposes, the quantity worked out to 17 gallons per head.

The discussion was then closed; members who had not taken part being invited to contribute their views for publication in the transactions.

The three authors were thanked for their contributions to the proceedings.

LORD RAYLEIGH ON LIGHT.

A course of five lectures on the subject of "Light" has lately been delivered at the Royal Institution by Lord RAYLEIGH, some notes on which we give below from the report which appeared in "The Times."

In his first lecture, Lord Rayleigh said he proposed to treat his subject more especially from the point of view of the wave theory. Light, like sound, was, he remarked, propagated by waves; and various questions presented themselves for consideration about these. Their length, which could be measured with extreme precision, was just on the limits of microscopic vision; their velocity was very high, but it could be measured with considerable accuracy; while their periodic time was inconceivably great. Turning to some of the phenomena exhibited by light, Lord Rayleigh observed that he need say little about reflection. Refraction, however, was not so simple. The bending of a ray of light on its passage into water had been known for thousands of years; but the law expressing the relation between the angles of incidence and refraction was discovered at a much later date by Snell or Descartes. As to the nature of this "law of sines." Light passing through a refracting medium with parallel sides left much the same as it entered—being on leaving refracted back to nearly its first condition. But with prisms the phenomena were more complicated. White light passed through them did not remain white, but was split up into its constituent colours. There was a paradox, even from the physical point of view, in saying that coloured lights were contained in white light. But light might be thought of as coming on to us like sound; and an analogy might be drawn from the line cut in the wax of a phonograph. This contained all the different sounds that reached the instrument; and in the same way, if we could see the curve of light, it would contain all the colours, though we should not be able to recognize any particular colour by inspection. The lecturer then illustrated the action of various absorbing agents on the colours of the spectrum, and said that on this basis the colours of ordinary objects must be explained. Colour was a shadow, resulting from the removal of light; and therefore a substance which absorbed all the colours of the spectrum but one was [illegible] which it did not absorb. If we had an ideal blue glass, cutting away the red, yellow, and green, and put with this a red glass, we should not mix the colours and get purple; but, since the colours acted by subtraction, we should obtain nothing but blackness. A piece of white paper reflected light containing all colours in equal degree. If it were painted, the colour was not generated in the act of reflection, but was produced by absorption; the layer of paint might be regarded as stopping certain colours out of the white light reflected by the white paper underneath. There were, however, some colours not produced by absorption, such as those of the spectrum and of soap-films.

In his second lecture, after a few remarks on compound colours, and after showing by experiment that yellow is not, as sometimes supposed, a simple colour, the lecturer discussed the question how the colour of a body was to be defined. Light passing through a very thin layer of a substance, or, what came to the same thing, a very dilute solution, differed little from white; but as the layer was made thicker or the solution stronger, the colour became deeper. We must therefore give up the idea that the liquid had one colour—it was a question of the thickness. In researches on light, we were not dependent solely on the eye; photographic methods were available. The notion that the rays at the violet end of the spectrum were exclusively the photographic rays was an error, though the photographic preparations generally used were most sensitive to the blue and violet rays. The result was that the blues came out too light, and the reds and yellows too dark. The ultra-violet rays were not light in the narrow sense, but were exactly analogous in their properties to visible rays, from which they differed only in the shortness of their wave-lengths. Lord Rayleigh then passed on to consider refraction from the point of view of the undulatory theory, and defined the "refractive index." The interpretation of the fact that a beam of light was bent on entering water was that light moved less quickly in water than in air. Refraction depended simply on the difference of the velocity of light in two substances. In a prism, the light was more and more retarded as the thick end was approached, and therefore the emergent beam was bent away from the thin end. In a lens, light passing through the centre was retarded in comparison with that passing through the thin circumferential parts. All the rays converged at one point (the focus), because those traversing the thick part, though they had an optical disadvantage, yet had a geometrical advantage, as regards the distance they had to travel, while those passing through the thin parts with an optical advantage had a geometrical disadvantage, and these advantages and disadvantages just balanced each other. As to the heat rays of the spectrum, Sir W. Herschel showed experimentally that all parts of it produced some heat, but that the small amount at the violet end quickly increased as one came down to the ultra-red region.

In his third lecture, Lord Rayleigh began with some remarks on achromatic lenses. The images of single lenses were, he said, imperfect by reason of the dispersion of the colours; for, the bending of one kind of light being greater than that of another, the point of convergence of blue rays was not the same as that of red rays. The successive employment of crown and flint glass abolished colour; but the light was still turned from the straight line. The remedy, however, was not quite perfect, for secondary colours were still outstanding, and became important in large instruments. Lord Rayleigh then proceeded to discuss the theory of the colours of thin plates, which, he said, was one of the foundation stones of the wave theory. The main facts had been developed by Newton; but Young was the first to explain the colours on the basis of the undulatory theory. The lecturer showed the production of "Newton's rings" by passing light through two pieces of glass (one convex) pressed tightly together, and explained that the thin film of air between them was the operative factor. To obtain the colours in full purity, precautions must be taken to cut off the reflections from the two outside surfaces of the glasses, which had a diluent effect. There were other ways of getting rid of this "false light." A film of soap might be used. The lecturer went on to explain the formation of these colours. Light was reflected from both surfaces of the film. Thus there were two trains of waves of a particular wave-length. What happened when these occupied the same space? If the crests coincided, the effects were added and the amplitude doubled. In the contrary case, where the crests of one train fitted the troughs of the other, there was neutralization, with decrease or almost total obliteration of light. Thus, if homogeneous light was being employed, whether brightness or darkness was obtained depended on the interval between the two reflecting surfaces—in other words, on the thickness of the film.

In his fourth lecture, Lord Rayleigh remarked that the impossibility of obtaining light of absolutely definite wave-length limited the number of bands. With small retardation, the bands were distinct, but faded away as it got greater. Light being a mixture of waves of nearly the same length, there came a point when the interference failed, and gave way to a uniform gray. It was an interesting question in molecular physics how near one could get to absolutely homogeneous light. Michelson, who had been most successful in this respect, used the light given off by an incandescent gas electrically excited in a vacuum tube. The best results had been obtained from cadmium. Lord Rayleigh went on to show the curious effect produced on

Newton's rings when regarded through a prism. A remarkable lack of symmetry was apparent; the rings on one side were obliterated, while on the other far more became visible than when the prism was not used. They were also achromatized. Newton was much struck by the phenomenon, but did not attain a satisfactory explanation. Lord Rayleigh showed that it depended on the curved form of the thin plate of air which was the source of the colours. He then discussed the interference bands noted by Young and Fresnel. If light from two perfectly similar sources simultaneously reached a point equidistant from both, the rays would coincide and produce brightness; but if the point was not quite equidistant, there would be neutralization of the waves, and consequently darkness. In this experiment, though two sources of light were spoken of, yet in fact the light must be derived from one. Two candles would not do, because there was no relation between the vibrations given off, nor would two of the best sources of homogeneous light as described by Michelson be successful. The only way was to use one source of light duplicated optically.

In his concluding lecture, Lord Rayleigh, referring to the researches of Young and Fresnel—the latter a man whose genius it was, he said, impossible to rate too highly—said both were unwilling to admit other than longitudinal vibrations of the ether. But the phenomena of polarization compelled recourse to the theory of transverse vibrations, or vibrations at right angles to the direction of the ray. The Nicol prism was shown to stop all vibrations except those in a particular plane; while a crystal of Iceland spar showed the ray split up into two, consisting of vibrations at right angles to one another. The difference was proved by analysis by means of a Nicol prism. These phenomena could not be intelligibly explained so long as light was assumed to consist of longitudinal vibrations like those of sound; while, on the transverse hypothesis, Fresnel fully worked out formulæ which experiment proved to be accurate. Light could also be polarized by reflection from glass at a particular angle; or conversely it could be shown that light already polarized could not be fully reflected except in the direction corresponding to the plane of its vibration. By means of a mechanical model, the relations between the plane of transverse vibration and the angle of reflection were graphically shown. When light was very bright, there was no angle at which polarization was absolute. For example, the image of the sun was always visible on water, even at the angle of minimum reflection. This apparent disagreement with Fresnel's formula was due, in Lord Rayleigh's opinion, to the presence of a dust or grease film upon the water. A chemically clean surface was almost impossible of attainment; but, if it could be secured, agreement with theory would probably be found to be complete. The dispersion of light by small particles was shown in a solution containing very finely divided sulphur. When a polarized beam was employed, the blue colour resulting from dispersion was seen in one direction only; there being no vibrations to be reflected at right angles to that direction. The blue colour of the sky was due to dispersion of light by small particles, not, as some have supposed, to oxygen or ozone in the atmosphere. Were the blueness due to actual colour, the sun would look blue, and the rest of the sky black. It was obvious that media reflecting differently must have different qualities. The difference must be one either of rigidity or of density; but the behaviour of small particles showed the effect must be due to one or other of these qualities, not to joint action of both. A number of interference effects shown on the screen served to illustrate the peculiar behaviour of certain crystals to polarized light. In conclusion, Lord Rayleigh touched upon the Röntgen rays, which have attracted so much attention recently. It had to be confessed, he said, that notwithstanding innumerable repetitions, we had not yet arrived much nearer to understanding the phenomena. The difficulty lay in the impossibility of applying the ordinary methods of analysis. Scarcely anything could be done with rays which one could neither reflect nor refract, nor pass through doubly-refracting crystals.

The Forthcoming Gas Exhibition in New York.—We learn from "Progressive Age" that a Charter has been granted by the State of New Jersey to authorize the organization of a Company, to be known as the Gas Industries Company, to conduct the affairs of the gas exhibition which, as already announced in the "JOURNAL," is to be held in Madison Square Garden, New York, early next year. At the preliminary meeting on the 11th inst., a number of influential gentlemen were elected Directors. The Michigan, Ohio, Pacific Coast, and Western Gas Association have all appointed representatives in connection with the exhibition.

The Work of the German Imperial Physico-Technical Institute.—A report on the work of the above-named Institute, embracing the period from April 1, 1895, to Feb. 1, 1896, has lately appeared. The staff consists of 71 members; and among other work done by them in the Physical Department was the fixing of the platinum standard of light. In the division of the Technical Department relating to photometry, 56 Hefner lamps, 232 incandescent electric lamps, 110 incandescent gas-lamps, 12 incandescent spirit-lamps, and 4 petroleum lamps were tested. In the workshop, 233 pieces of work for the various departments were executed during the period covered by the report.

REGISTER OF PATENTS.

Radiant Tissue for Incandescent Gas-Lamps.—Crocker, S. H., of Furnival Street, E.C. No. 12,105; June 21, 1895.

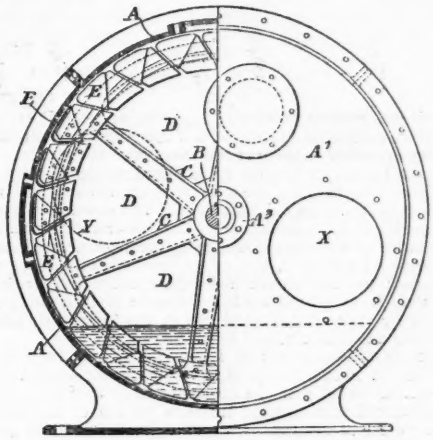
This invention relates to gas-burner attachments for producing incandescent light "from shreds obtained from a sheet composed of or containing cellulose and suitable refractory materials, such as the oxides of zirconium, erbium, lanthanum, silicon, or other metallic combinations well known for the purpose." Suitable shreds may be obtained, says the patentee, from paper which has been prepared or "loaded" with kaolin, heavy spar, permanent white, alum, or other substances commonly used for such purpose; but he prefers to substitute one or more of the refractory materials first mentioned for the preparation or "loading" of the paper, in order to secure slightly better results. The shreds are formed into suitable shapes for attaching to the gas-burners and producing the most incandescence, with a given degree of heat by weaving or interlacing the shreds together, and thus forming a fabric which can be made up into hollow cones, pyramids, or such like figures, or the fabric may be used in a flat shape only. The shreds may be also plaited in lengths, or woven or twisted together upon a frame, so as to obtain a hood or mantle of the required shape, without first weaving a fabric. The shreds of paper containing the refractory elements "may be arranged separately or conjointly upon a light frame—such as asbestos, platinum wire, or the like—and the individual shreds or pieces of the fabric formed by them may be secured together by a suitable cement." The organic matter contained in the shreds is subsequently removed in the ordinary manner by burning.

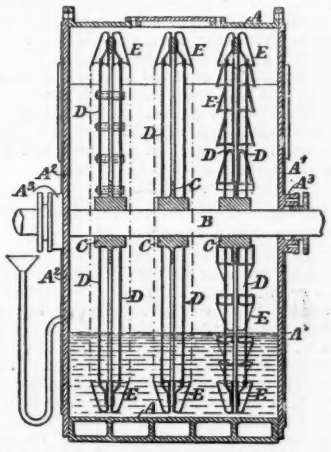
Holding Incandescent Gas-Lighting Filaments.—Gardner, H.; a communication from the Société Française de l'Héliogène, of Paris. No. 17,533; Sept. 19, 1895.

This invention has for its object the manufacture and employment of gutter, flat, round, or other shape, receivers, supports, or holders for the fringe filaments used for incandescent gas-lighting burners of the flat-flame type—such as are employed in the De Mare system.

Extracting Cyanides from Illuminating Gases.—Livesey, F., of Old Kent Road, S.E. No. 18,334; Oct. 1, 1895.

This invention relates to apparatus by means of which the gas to be treated is brought into contact with a film of some suitable liquid, which will have the effect of extracting and holding the cyanogen or other gaseous impurity.





The accompanying illustrations are an end elevation of the apparatus (one half having the cover removed) and a longitudinal section. A is a water and gas tight cylinder of suitable dimensions; the ends being closed by covers A^1 A^2. These closed ends are provided with bearings A^3 for a shaft B, on which is mounted a series of frames C, to carry perforated discs D, bolted to the frames, or secured thereto in any other convenient manner. At the outer peripheries of the discs are series of pockets E, which, as the shaft is rotated, dip into a suitable liquor contained in the lower part of the cylinder. The liquor is thus raised to the upper part, and is gradually emptied on to the discs, down which

it trickles; thus presenting a thin film, through which the gas under treatment has to pass.

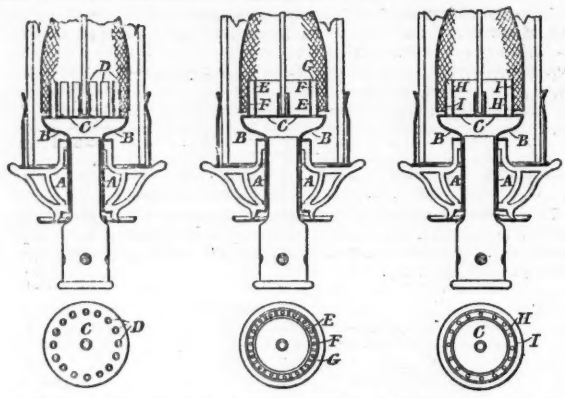
The gas enters at X at one end of the cylinder, and flows out at Y at the other end, having to pass through the perforated discs on its way. By these means the gas is caused to come into contact with a running stream of liquor, which takes up and retains the cyanogen or other gases, according to the nature of the liquor used.

The liquor flows into the cylinder by a syphon pipe; an overflow syphon to draw from the bottom being also provided at the other end of the cylinder. Means are provided (such as a fringe of brush work) to check too great a flow of gas between the inside of the cylinder and the edges of the discs.

The liquor is kept in a constant state of agitation by the moving pockets, so that any solid matter in the liquid can be kept in a state of suspension; and the liquor may be supplied constantly or intermittently, as required, flowing either in the same direction as the gas, or the opposite way. The velocity of the gas flowing through the apparatus will be regulated by the number of perforations in the discs, and the diameter of the discs and cylinder; and the inlet and outlet for the gas will be arranged according to a given pressure of gas.

Incandescence Gas-Burners.—Schroedter, P., of Berlin. No. 7477; April 8, 1896.

Three arrangements of this incandescent gas-burner are shown in the engraving; the lower part of the burner proper in each case consisting of a tube A formed at its upper end with a trumpet-like enlargement or chamber B closed by a disc C.



In the first construction of burner, a number of tubes D are arranged above the disc, preferably in a circle, and communicate with chamber B through corresponding holes near the outer edge of the disc.

In the second construction, the tubes D are replaced by a number of shafts G, formed by dividing the annular space between the two concentric tubes E F by radial partitions. The shafts like the tubes D may be provided in any number, and at any desired distance from each other; the circle of holes in the disc being arranged accordingly.

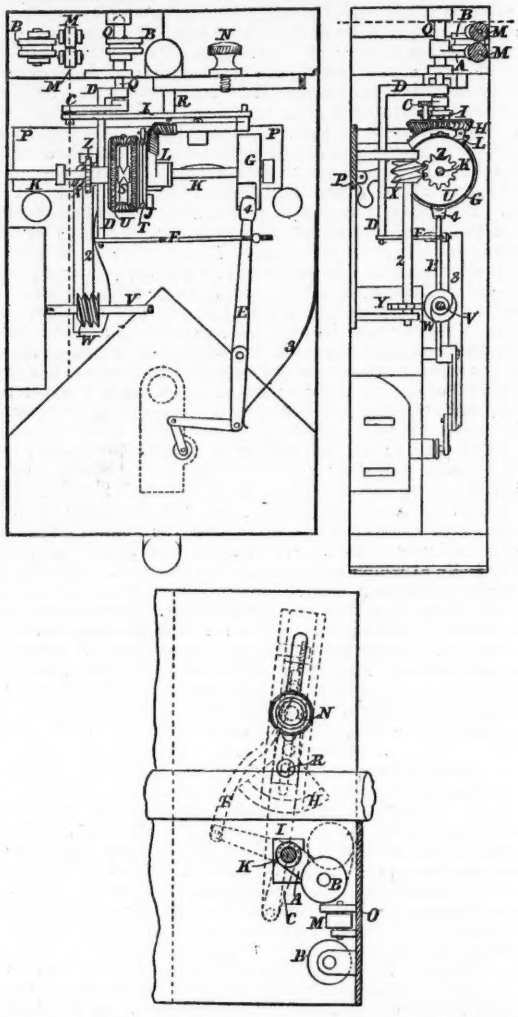
In the third construction, two concentric tubes H I are arranged above the disc; and the intermediate space above the circle of holes formed in the disc may be either left free or be divided in the direction of its height by horizontal rings placed in the interior or above, and furnished with a similar circle of holes.

The action of the burners is as follows: The gas admitted through the lower bunsen nozzle draws in atmospheric air against the upper cover plate C of the tube A. In consequence of this "an eddy is produced in the chamber B, causing intimate mixing of the gas and air, which then passes at a higher pressure through the circle of holes in the disc into the tubes D or shafts G or into the annular space H I; and, after being lighted at the upper edge, burns as a blue flame cone. At the lower edge of the flame cone, a special cone of small pointed flames is thus formed, due to the division of the burner head by the tubes, shafts, or holes. This circle of flames is distinctly preceptible after the removal of the incandescence mantle, as in contradistinction from the blue flame cone, it possesses a tint verging on green. By lateral radiation, it exerts a strong heating action upon the lower part of the incandescence mantle, so that this part will emit light of the same intensity as the upper part of the mantle."

Automatic Gas-Meters.—Brightman, J., of Rotherham. No. 8613; April 24, 1896.

This is a slot-meter constructed as follows: Two rollers B are placed at the back or under side of the slot plate O, partly obstructing the slot. One roller is in a fixed position at the end of the slot; the other is attached to a lever or arm A, and resting under the slot, a little past the centre towards the opposite end. When a coin is placed edgewise in the slot, the edges of it rest upon the two rollers. Then, by pushing the coin down through the slot, the lever is moved radially, until the distance between the rollers is equal to the diameter of the coin, which then falls through into a money-box below. Two small eccentric rollers M (made of vulcanized india-rubber, or other substance that will not readily slip on the surface of the coin), are placed in a plane with the rollers, at right angles to them, and attached to the slot plate by lugs. The rollers are so placed that, as the coin passes down between them, it slightly displaces, or partly turns them, without any perceptible resistance; but the coin cannot return, or be drawn upwards, being prevented by the eccentric form of the rollers. The lever A is fastened on a spindle Q; and to the same spindle are attached two other cranks or levers C D. The latter is connected to the pulling rod F, and by it connected to the valve-lever E, in such a way that it pulls the lever, but does not push on returning. I is a lever having its fulcrum at R. One end is connected to the crank C, and the other to a quadrant H (slots are made in the lever I, for the studs to work in which connect it to R and H). The motion of the lever A is thus communicated to H and E at the same time.

The lever E is standing in a gap cut in the circular cam G, when the valve is shut, and the roller B is in the position shown in fig. 3. The movement of D pulls the lever E out of the gap, and thus opens the gas-valve. At the same time the quadrant H (conveying its motion through the bevel quadrant L with the pawl and groove wheel J) moves the cam G, so that E cannot return to the gap, but settles on the face of the cam, which causes the valve to remain open. The weight of the two quadrants H and L and the position of the two cranks and lever cause the arm A (with its roller) to return to its former position the instant the coin has passed the centre of the rollers. This returning action can be supplemented by a spring acting downwards upon L if



necessary; and the operation can be repeated until the cam G has completed a revolution except the width of the gap—the rod F sliding loosely over the valve-lever. The two bevel-wheels T U are loose, and act separately upon the spindle K, by means of the cross-bar S, which is fast on K. The spindle V is the indicating spindle of the meter, which (by means of two worms W X, geared into wheels Y and Z, and connected by the spindle 2) causes the working of the meter to move the cam G, in the opposite direction, until the gap reaches the lever E, which (by the pressure of the spring 3) is forced into the gap, and thus closes the valve with which it is connected. The roller 4 is intended to reduce the friction between G and E. The fulcrum R is attached to a slide, held in position by the screw N; and it can be shifted along a slot in the lever I so as to regulate the movement of the quadrant H, and thus measure the amount of gas for each coin put in.

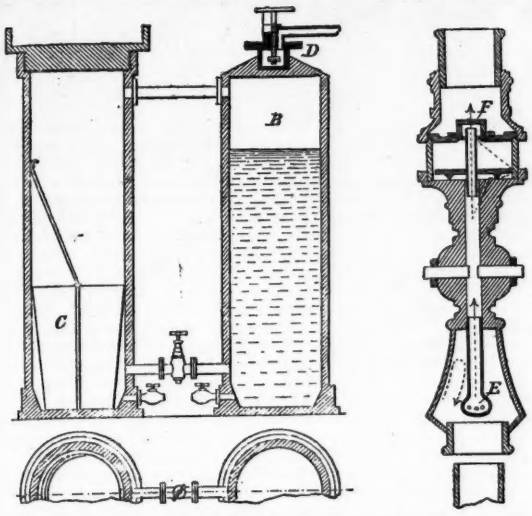
Generating Acetylene Gas.—Bauweraerts, E. F. J. C., of Brussels. No. 11,708; May 29, 1896.

This invention relates to apparatus for generating acetylene gas, and to a device for regulating the yield of the gas.

The illustrations on next page show a vertical section and a horizontal section of the generating apparatus, and a vertical section of the pressure regulator or governor.

The generator comprises two reservoirs A and B of steel, enamelled internally. The reservoirs communicate with each other at top and bottom by pipes—the lower one fitted with a cock; and the two reservoirs are fitted with a discharge or blow-off. The reservoir A into which the carbide of calcium is placed is closed at its upper part by a cover or screw-plug of large size adapted to screw into the shell of the reservoir, and provided with two handles. The removal of the cover permits of the introduction into the reservoir of a pail or bucket C charged with carbide, and having its external surface formed with longitudinal slots or grooves to allow of the water passing into the receptacle so as to come into contact with the carbide. The reservoir B which contains the water is provided at its upper part with a stop

valve D for regulating the discharge of the gas. When the two reservoirs are charged, the one with the carbide and the other with water, the cock on the lower pipe is opened; and the water in rising up along the outer wall of the pail comes in contact with the calcium, and



acetylene gas is at once generated. It passes into the reservoir B wherein it exerts a pressure upon the water in it in such a manner as to render the production of gas continuous. On leaving the reservoir B, the acetylene passes to the regulator, which is fitted with a gauge to indicate the pressure in the pipes.

The regulator consists essentially of a bell of conical shape so designed as to accelerate the ascending movement of the gas. In the bell is arranged a gauge or test tube E, the bottom of which is of bulging form, and perforated with numerous apertures of suitable size. It extends down to within a small distance of the bottom of the bell; and the top communicates with the pipe which starts from the top of the bell, and is fitted with a cock designed for regulating once for all the pressure of the gas in the pipes. The pipe is provided with an auxiliary pipe or branch, which ascends obliquely, and terminates under the disc of the valve F. This rests upon three projections; and through its centre there extends a tube fitted at one end in the pipe, and at the other end in the opening of a second disc mounted on the top of the valve. This opening has fitted over it a cap against which the tube bears when the current of gas passing through the branch pipe lifts entirely up the disc of the valve. The tube has apertures above the disc, in order to allow the gas to escape right and left when the valve is entirely lifted.

APPLICATIONS FOR LETTERS PATENT.

17,992.—Lux, F., "Water-meters." Aug. 13.
18,021.—Jackson, J., "Incandescent gas lamps or pendants." Aug. 14.
18,051.—Holt, H. P., "Gas or oil motor cars." Aug. 14.
18,090.—Appleyard, E. P., "Detecting or preventing fraud in coin-freed automatic machines." Aug. 15.
18,098.—Cowan, W. & W. H., "Prepayment gas-meters." Aug. 15.
18,103.—Gillespie, M. M'A., and Wynne, W. R., "Electricity and other supply meters." Aug. 15.
18,116.—Russell, J. F., "Gas-motor." Aug. 15.
18,171.—Hampton, C. & G., "Gas-brackets." Aug. 17.
18,207.—Pictet, R. P., "Manufacture of acetylene." Aug. 17.
18,208.—Pictet, R. P., "Purification of acetylene." Aug. 17.
18,222.—Figge, A., "Incandescent gas-lamps and the like." Aug. 17.
18,226.—Boult, A. J., "Burners for stoves and the like." A communication from G. Barthel. Aug. 17.
18,253.—Beal, W., "Gas-lamps." Aug. 18.
18,283.—Gäbel, R., "Regulating the admission of gas into incandescent and similar burners." Aug. 18.
18,294.—Abel, C. D., "Starting gas and oil motor engines with twin cylinders." A communication from the Gasmotoren Fabrik Deutz. Aug. 18.
18,297.—Hancock, D., Craig, J. B., and Hancock, A. H., "Prevention or reduction of vibration in gas-burners." Aug. 18.
18,324.—Parkes, W. H., "Motors applicable to machinery, steam, gas, or electric engines, and the like." Aug. 19.
18,368.—Kellner, G., and Faugère, M. M. L. G., "Starting gas or oil engines." Aug. 19.
18,402.—Werthen, M., "Gas heating and cooking apparatus." Aug. 19.
18,459.—Kochs, W. E., "Coal conveying and discharging apparatus." Aug. 20.
18,464.—Orling, E., "Electric gas-lighters." Aug 20.
18,493.—Levin, S., "Mantles for incandescent gas-lighting." Aug. 20.
18,534.—Penny, R. J., "Gas-stoves." Aug. 21.
18,575.—Sheard, J. T., and the Sheffield United Gaslight Company, "Obtaining cyanides in the manufacture of gas." Aug. 22.
18,585.—Arrol, Sir W., and Johnston, G., "Oil or gas motors for wheeled vehicles, and for general purposes." Aug. 22.

New Joint-Stock Companies.—The "Best" Incandescent Gas Share Syndicate, Limited, has just been registered with a capital of £25,000 in £1 shares, to enter into an agreement with S. H. Crocker, and to manufacture, sell, and deal in incandescent gas mantles, burners, and fittings for the same. The Magnetite Sewage and Water Purification Company, Limited, with a capital of £30,000 in £1 shares, is to acquire the business now carried on by Mr. G. H. Skelsey at Mostyn and in Manchester.

CORRESPONDENCE.

[We are not responsible for the opinions expressed by correspondents.]

The Permanency of Illuminating Gas.

Sir,—I have read with considerable interest Mr. A. F. Browne's criticism of my paper, upon "The Permanency of Illuminating Gas," read before the North British Association of Gas Managers. I have also read, with equal interest, Mr. Browne's contribution to a kindred Association on the same subject.

Mr. Browne's criticisms are mainly directed to that part of my paper which reflects upon the results he has obtained through the method of treating or enriching coal gases by means of volatile hydrocarbon vapours added to the gas during the process of condensation; and he appears to be of opinion that, neither from my premises regarding (what I may be allowed to term) the physics of the diffusion of vapours through gas, nor yet from the inference drawn from practical experience, am I justified in so reflecting upon such a process.

I gather from Mr. Browne's criticism and communication that he admits—nay, he asserts—that the addition of the vapours of volatile hydrocarbons to the gas after condensation in quantities much greater than that added during the process of condensation, fails to retain the naphthalene in diffusion. He does not give any clear explanation why the vapours should have such different effects when applied under the different conditions. He appears, however, to be under the impression that the volatile hydrocarbon vapours, when added during the process of condensation at the proper stage, have the power in some way or other of enabling the vapours so added to form links, so to speak, in the solubilities of the various vapours and gases present in the crude coal gas at the point where the vapours are introduced; that thus the combined vapour tension of the compound gas is so raised as to keep the whole in a gaseous state; that not only is the ordinary percentage volume of naphthalene vapour retained in diffusion through the gas, but that there is a considerable extra quantity present, as the added vapour prevents its precipitation; and that this extra quantity of naphthalene and other diffused hydrocarbons greatly increases the illuminating power of the gas.

Now, as explained in my paper, many years ago I entertained the similar idea that the solvent affinity of one hydrocarbon for the other might make it possible to utilize the cheap hydrocarbon naphthalene, so as to make it—in conjunction with other hydrocarbons—form a substantial part in the carburetting of air to form pneumatic gas. Experiments and experience very soon convinced me that air or any other gas could, at any given temperature, take up and hold in diffusion a given volume of naphthalene vapour, and that the addition of the vapours of any other volatile hydrocarbon or series of hydrocarbons did not increase the power of the air to take up in diffusion, or to retain in diffusion, a larger volume of naphthalene; that the solubility of the hydrocarbons in each other lowered their combined vapour tension to less than it would have been had they been mutually insoluble; that the combined vapour tension of mixed hydrocarbons was only equal to the mean of the two separate tensions, instead of being equal to their combined tensions had they been mutually insoluble; and that, therefore, when hydrocarbon vapours were added to a gas already saturated with naphthalene, unless the tension of the added vapours were exceedingly high, the naphthalene was precipitated, and frequently in an extremely finely-divided condition.

The results of all those experiments would lead me to infer that the vapours of volatile hydrocarbons would ultimately have nearly the same effect whether added in the condenser or after condensation.

While expressing this opinion, however, I am ready to admit, and have admitted in my paper, that I had no doubt but that results similar to those realized by Mr. Browne might be obtained at points not far distant from the place where the hydrocarbon vapours were added to the coal gases in the condensers; but that just as I found in some of my experiments on the diffusion of naphthalene in combination with other hydrocarbons through air, the enrichment was not due to increased vapour tension or solvent action resulting from the commingling of the hydrocarbon vapours, but to the naphthalene being precipitated in such an extremely fine state of division that it was carried forward in the current of gas.

The distance to which such precipitated finely-divided hydrocarbon will travel with the gas is dependent upon the fineness of the state of division and the filtering out or rubbing surfaces to which it is exposed. The fineness of the state of division is dependent upon a number of conditions which are present during the treatment of the coal gases in the condensers by the injection of hydrocarbon vapours; and just as these conditions vary, so will the fineness of the state of division of the precipitated naphthalene, and, as a consequence, the quantity carried forward in the current of gas. This fact would account for the very large variations in the results obtained by Mr. Browne.

Naphthalene, or other hydrocarbons, when diffused through the gas in an extremely fine state of mechanical division, may be carried forward in the current of gas through long distances. We have a good illustration of this fact in Mr. Botley's process, at Hastings, of mechanically diffusing paraffin oil through gas so as to prevent trouble from naphthalene deposits; and a still better one in the case of the difficulty experienced in precipitating and separating the extremely finely-divided metallic oxides present in the fumes from smelting operations.

Naphthalene carried forward in this extremely fine state of mechanical division, is not nearly so liable to give trouble in the mains and services as naphthalene held in diffusion in the form of vapour. The former, when it is deposited by a purely mechanical process, accumulates only in positions where the speed of the gas is slow, and, being in the form of a fine powder, it is liable to be wafted forward when the current of gas increases; and it also naturally falls to the lower parts, where it is liable to be washed forward into the drips by any deposited liquids. On the other hand, when the naphthalene is in the state of gaseous diffusion, it passes directly from the gaseous to the crystalline state; the crystals are deposited upon all surfaces having a temperature lower than the saturation-point of the gas; and the crystals of naphthalene attach themselves to, and grow upon, these surfaces, whether vertical or horizontal, and go on accumulating till they cause an obstruction.

The crystals, being large, comparatively hard, and coherent, are difficult to remove.

Mr. Browne appears to have some doubts about the true cause of naphthalene deposits, and particularly whether these are ever due to the conditions just referred to—viz., the gases being so charged with naphthalene as to reach the point of saturation at the lowest temperature to which it is likely to be exposed. He further queries the negative evidence adduced in my paper in support of my views of the subject. He says: "Gas makers generally agree that increased enrichment is followed by reduced deposits; and if it be true that the richer coal gases of the North are less attended by such deposits than the poorer gases of the South, the case for other causes would appear to be strengthened." Mr. Browne then gives the accepted "other causes" as friction and condensing aqueous vapour. There is no doubt about the truth of Mr. Browne's statement of the facts regarding the results of enrichment; but his inferences therefrom appear to me to be open to question.

Enriched coal gases are undoubtedly less liable to give trouble than pure coal gas; but the reason is simply that, volume for volume, enriched coal gases contain in diffusion a less, not a larger, volume of naphthalene vapours accompanied by a large volume of the vapours of condensable liquid products. This fact is made perfectly clear in my paper.

The volatile constituents diffused through an illuminating gas invariably bear a relation to the condensable products produced during the process of carbonizing. Illuminating gas produced from ordinary bituminous coal distilled at high temperatures is accompanied by a small volume of condensable products—these products containing a very high percentage of naphthalene, a small percentage of volatile hydrocarbons with a vapour tension such as to enable them to remain in diffusion in the gas, and also a proportionately small volume of less volatile products suitable for taking up the excessive volume of naphthalene in solution. The consequence is that the gas is left saturated with naphthalene vapour, accompanied by a small volume of volatile hydrocarbons. The saturation-point of the gas in respect of naphthalene is reached long before the saturation-point for the other hydrocarbons; and the naphthalene, losing its solvent affinity in passing to the solid state, is consequently deposited as dry crystals, causing obstruction.

If the naphthalene, in passing from the gaseous state to the solid crystalline form, had possessed a solvent affinity for the other liquid hydrocarbon vapours diffused through the gas as a liquid hydrocarbon with a similar vapour tension would have possessed, the naphthalene would have absorbed some of the accompanying vapours; but, as I stated in my paper, crystalline naphthalene has no such solvent affinity for hydrocarbon vapour, or at most a comparatively feeble affinity. Hence my reason for drawing attention more particularly to the effect of the addition of vapours of hydrocarbon liquids in keeping naphthalene in diffusion, and preventing trouble from naphthalene deposits.

When, on the other hand, rich illuminating gas is produced from cannel, or when coal gas is enriched by carbonizing cannel or other enriching material in conjunction with coal, the accompanying condensable products are much larger in proportion to the volume of the gas. Besides, they have a modified composition; for they contain a much smaller percentage volume of naphthalene, a larger percentage volume of volatile hydrocarbons, and also a proportionately larger volume of those dense hydrocarbons which are suitable for taking up and holding naphthalene in solution. The resulting gas consequently leaves the condenser less saturated with naphthalene, owing to the larger solvent or washing action of the dense liquid hydrocarbons; and the volatile hydrocarbons with high tension left in diffusion is proportionately larger. The saturation-points of the various hydrocarbons (solid and liquid) diffused through the gas are thus made to approach more nearly to each other; and, therefore, when such a gas is cooled, the naphthalene is not deposited alone, but is accompanied by so much hydrocarbon liquid that it is dissolved, and washed into the drip-traps, and thus obstruction is prevented.

When enrichment is done by means of volatile hydrocarbons—as in the Clark-Maxim process—after the gas has passed through the manufacturing plant, the effects are somewhat different. The increased volume of the gas due to the presence of the added hydrocarbon vapours acts approximately as if the original coal gas saturated with the naphthalene had been allowed to expand, under reduced pressure, to a like volume; or as if a volume of hydrogen or other high-tensioned gas, free from naphthalene vapours, had been added to the original coal gas. To a certain extent, the added volume would act as a vacuous space, through which the naphthalene present in the coal gas would diffuse. But it would not be quite to the same extent, as, the naphthalene and the carburetting fluid being soluble in each other, their combined tensions would only be equal to the mean of the two separate tensions; and as the tension of the vapour of the carburetting hydrocarbon is much less than that of hydrogen or other similar high-tensioned gas, the added vapour would have proportionately less power to hold the naphthalene in diffusion than would result from either the distension of the gas by relief of pressure or the presence of the added volume of a gas free from naphthalene.

If this view of the matter be a sound one, then it follows that, to prevent trouble from naphthalene deposits under this method of enrichment, it will be necessary to use such a quantity of hydrocarbon vapours that either the increased volume will be such as to hold the naphthalene in diffusion, or that such a balance is brought about between the saturation-point of the gas with naphthalene and the other hydrocarbon vapours that they are simultaneously condensed and deposited upon gas being cooled, so that the naphthalene is thereby kept in solution, and carried to the drip-traps.

Now with regard to the other conditions which Mr. Browne looks upon as the main cause of naphthalene deposits—friction and condensing aqueous vapour. Friction can only take place in moving currents of gas; and one of the results of such friction is to raise the temperature by changing the mechanical energy of the current into heat energy. As a rise of temperature would raise the vapour tension of the components of illuminating gas, it is difficult to comprehend how, if the naphthalene is held in the gas in the form of vapour, friction could possibly cause its precipitation.

It is admitted that friction does cause a reduction in the illuminating power of gas; but it appears to me that the true cause is that the hydrocarbons present in the gas which are precipitated by friction are not in the state of vapour, but are suspended in the gas in the extremely finely-divided mechanical condition to which I have already referred, and that the friction simply rubs out of the gas those suspended hydrocarbon particles.

There can be no friction in a main in which the gas is at rest or stagnant. Yet it is well known that in such a main gas rapidly falls in illuminating power. This is no doubt due to those finely-divided suspended mechanical hydrocarbon particles dripping out of the gas owing to their higher specific gravity.

The conditions which lead to the precipitation of naphthalene held in diffusion in the form of vapour and those causing water vapour to condense out of coal gas, are in many respects identical; and as it has been observed that both these condensations take place at the same instant of time, the condensation of the water has been assigned as the cause of the condensation of the naphthalene. But it would be equally reasonable to assign, as the cause of the condensation of the water, the condensation of the naphthalene. It is true that, being insoluble in each other, the vapours diffused through each other—their combined tensions being equal in their separate tensions. Consequently, when the one is condensed, the vapour of the other diffused therein is simultaneously condensed; and to this extent condensing water vapours affect the condensation of naphthalene. The volume of water vapour thus removed is, however, extremely small. The real cause of the condensation is, no doubt, the fall in temperature leading to the supersaturation of the gas with naphthalene and watery vapour, and the consequential deposit of the naphthalene in the crystalline form; and as the condensed water has no solvent action upon the naphthalene, this is left in the crystalline condition, and causes trouble.

In writing my paper, my main object was to clearly define what were the conditions necessary to render a gas permanent. I had no inclination whatever to pillory any idea on the subject of the deposition of naphthalene from gas. On the contrary, I suggested what appeared to me to be a possible explanation of the facts stated to have been observed. No one will be better pleased than I to find that Mr. Browne has made a discovery in gas manufacture likely to benefit all concerned, although that step should be the means of showing that my ideas were in error.

WM. YOUNG.

Peebles, Aug. 26, 1896.

Mr. Damon and the Evans Photometer.

SIR,—Until Mr. Sugg produces evidence of a more substantial nature, I unhesitatingly hold to my opinion as to the unsuitability o the Evans photometer for the accurate testing of the illuminating power of coal gas. Granting, for the sake of argument, that it may give correct results with proper surroundings, there remains the fact that its construction is such that it is possible, by mechanical alterations, to both raise and lower the apparent value of the gas. This alone is sufficient to condemn any photometer; and plenty of proof exists that perpetual dispute and friction are caused by the varied results obtainable on such an instrument.

Mr. Sugg states that the Gas Referees themselves deliberately adopted this instrument; but he omits to add, as an explanation of the fact, that Mr. F. J. Evans, the inventor, was at that time one of the Referees.

I can assure Mr. Sugg that I have no desire to shirk responsibility. I am quite prepared to substantiate my experiments, and to prove every statement I have made. His questioning the accuracy of my experiments, and throwing discredit on my actions as a Gas Examiner and an officer of the London County Council, is, I take it, a device on his part to divert attention from the main point in the discussion. I think, however, that it is to be regretted, in the interest of the subject, that a gentleman of Mr. Sugg's undoubted ability and experience thus allows himself to go so far beyond the bounds of fair criticism.

I must remind Mr. Sugg that I have not suggested that photometers should be constructed to suit the circumstances of their situation. What I am advocating is the doing away with the already too varied forms that unfortunately now exist, and the adoption of a standard instrument which with a reliable standard will give practically accurate results. Such an instrument would place photometry on a fair basis, and, in my opinion, be welcomed as much by the gas companies as by public bodies.

Mr. Sugg states that "no one knows the precise nature of Mr. Damon's screens and other modifications; and therefore no estimate can be formed as to the reliability of his results." This is a mistake on the part of Mr. Sugg. The then Gas Referees (Mr. Vernon Harcourt, Dr. Pole, and the late Professor Tyndall), and also Mr. Dibdin—gentlemen whose actions I am sure Mr. Sugg will admit as being above suspicion—were in full possession of every particular in connection with the experiments, and the varied conditions under which they were made. Those particulars are still in existence, and are, I am quite sure, at the disposal of Mr. Sugg, *if he really desires to have them*. I have, of course, my own notes, and shall be pleased to furnish him with any information he may care to have.

Mr. Sugg's repetition of his remarks on my evidence on the Evans photometer and the Dublin Corporation before the House of Lords Committee is very easy to understand. In reply to it, I can but repeat that I did, and do, maintain that the instrument in use in Dublin for testing the illuminating power of gas is not an Evans photometer as invented by Mr. Evans, and that it is of such a form as to give an artificial value to the gas.

ALFRED F. DAMON,
Gas Examiner to the London County Council.

123, *Ladbroke Grove*, W., *Aug.* 28, 1896.

The Water Companies and Household Storage.

SIR,—I am pleased to see the water question discussed in the "JOURNAL" for Aug. 18, p. 322, showing that "cisterns are a necessity with constant water supply." I discussed this question in the "JOURNAL" for Dec. 20, 1887, p. 1090; and that communication will corroborate all that Dr. Pringle has written.

Notwithstanding what has already been said on this subject, the

sanitary authorities are still enforcing a system calculated to promote disease and death among all classes. Constant supply without storage cannot be carried out in its entirety without danger to the community. Take an example of a street of a thousand large lodging-houses, hotels using lifts, and a number of other supplies on the side streets dependent on the same main. There will be repairs daily to the services, mains, cocks, or hydrants, and sections of the main must be shut down from one hour to five hours at a time, when the district will be out of water. The lodging-houses and hotels must be provided with sufficient storage in proportion to the requirements of the household, to keep the boilers going. A house with twenty or more visitors will require baths at all hours of the day, and cannot be worked without sufficient storage of water for drinking and cooking purposes. Or take the class of houses, as at the East-end of London, inhabited by artisans. The evidence now before the public should show the modern sanitarian and the county councillor that water for immediate use is necessary at all hours, and must not be dependent upon turning off for innumerable breakages, repairs to services, and stopcocks, alterations, and laying on of new supplies, &c.

The tendency of all Acts of Parliament relating to the supply of water since 1847 has been to cause cisterns to be erected, properly fixed where there is a constant supply; and it is in the interests of the community that there should be proper storage cisterns affixed to each house in case of a water famine.

The author of the Act of 1887, "limiting the powers of the company to cut off the tenant's water supply," once stated that the ¾-inch pipe leading from the main to the house was a "proper receptacle for the supply of water," which I take to mean a sufficient storage cistern. But the Judge very properly ruled that such "fittings" did not amount to such a receptacle as a "cistern" used when constant supply was enforced, and as the company were entitled to require. Probably the author's opinion is somewhat changed under the present state of affairs in London.

I regret to learn that the cisterns from whole streets of small houses have been removed by a certain class of builders; leaving the household entirely dependent on the one tap direct from the main. This is being advocated by some water-works engineers also; and the bye-law is now printed in the company's regulations. I have known the whole of the street shut off for five or six hours at one time for repairs. One can imagine the sanitary state of some of these tenements, unnecessarily deprived of water. If an epidemic should result, caused by succeeding years of drought necessitating intermittent supply, the blame must be borne by those advocating non-storage of water instead of dealing with the question in a scientific and practical manner. The original storage "butt" in the poor quarters of London was a danger and disgrace to the owners of property and sanitary officials—being always placed in the most filthy part of the court, adjoining the water-closet or ash heap; and having no cover, it was often used for the most filthy purposes. But this criminal neglect of owners and officials can be no reason for abolishing altogether the practical necessity for storage. The object-lesson is now before the water-works engineer and the sanitary inspectors at the East-end of London.

It is quite practicable to build a galvanizing iron cistern in brickwork with a perfect lock-up cover and a strong iron lock-up draw-off tap which would not be worth stealing. Even in the best houses, the cistern is often placed in the roof or in some inaccessible place; and it is never seen or cleaned. Surely, if a house is provided with a larder, it might be made large enough to fix an earthenware cistern of sufficient capacity for the household's use for drinking and cooking for (say) three hours.

In some towns there are hundreds of water-closets supplied direct from the mains, which is the most fruitful source of all waste. The moment the water is shut off, the whole house is not only deprived of water, but all the pipes are filled with foul air from the pans of the closets. In some known cases this has caused an alarming epidemic; but supposing there is a two-gallon flushing cistern fixed which is not fed from a storage cistern, then the foul air from the closet rushes into the empty pipes in precisely the same manner—showing the absolute necessity for providing a storage cistern in either case, also for feeding the hot-water boiler and for drinking and cooking purposes.

I have not seen the literature of the Great Exhibition of 1884, referred to by Dr. Pringle; and I am certain that many of the readers of the "JOURNAL" will be glad to study the "description of cisterns scientifically constructed and placed" which he promises to illustrate and describe. The scientific cistern mostly used will probably be that with the bottom tapered towards the centre, and provided with a wash-out plug discharging over a sink, or over the rain-water trap. This cistern is self-cleansing and more "scientific" than the ordinary flat-bottom cistern with its usual two inches of sediment.

The cistern I prefer to use is the water-works' improved upright self-cleansing cistern. This is made of glazed earthenware, having an upright ball-valve. All the parts of this ball-valve and the cover of the cistern are enamelled. The cistern, being used for drinking and cooking purposes only, is fixed in any part of the building easily accessible to the servants and for inspection by the head of the household. It is properly lagged and protected from the frost. The upper edge or lip of the cistern is turned over outwards to prevent insects entering. The water is drawn off about 18 inches under the surface; and the supply being constant, the cistern will fill as fast as the water is drawn off.

As the British Association of Water-Works Engineers are now fully organized, we may look for valuable discussion on this important and timely topic.

Aug. 28, 1896. INSPECTOR.

The Blea Tarn Water Scheme for Lancaster.—Last Wednesday, in the presence of a large and influential company, the Mayor of Lancaster (Alderman W. Huntington) who is Chairman of the Corporation Water Committee, cut the first sod of the new water storage reservoir at Blea Tarn, the construction of which is estimated to cost about £60,000; and its storage capacity in round figures will be 120 million gallons. As a memento of the occasion, the Mayor was presented with a beautifully finished silver spade; and, at the close of the ceremony, luncheon was served on the works.

LEGAL INTELLIGENCE.

THAMES POLICE COURT.—Wednesday, Aug. 26.

(*Before Mr.* CLUER.)

The Punishment of Wasteful Water Consumers.

The case of Mr. Peter Ringen and his wife, who were fined on the 20th ult. for wilfully wasting the water of the East London Water Company (see *ante* p. 372), was to-day again before the Court.

Mr. F. DEAKIN applied to his Worship either to reduce the fines or to allow the money to be paid in monthly instalments. The man, he said, was fined £3 and £2 costs; while his wife was ordered to pay an inclusive penalty of £5. Ringen, who was a hardworking man, paid 16s. a week rent, which sum was reduced to 11s. by his having a lodger; while his weekly wages were between 30s. and 35s. The value of his furniture would not amount to £10; and should a distress be issued, both defendants would be homeless. He suggested that the case was one in which the Court could properly exercise its powers, especially as he believed the penalty would go to the prosecutors.

Mr. G. KEBBELL, who appeared on behalf of the Company, said this was not so; and the only amount in which they were interested was the £2 2s. costs. On account of these proceedings, the Company were about £15 out of pocket.

Mr. CLUER said he had communicated with his colleague Mr. Dickinson on the matter; and they both agreed it was a case which should be treated in the way suggested by Mr. Deakin, and that the fines should be paid at the rate of £1 a month. It was not a matter in which the defendants ought to be sent to prison. The object was to deter other people from committing the same offence.

Mr. KEBBELL remarked that, if such people were allowed to pay the fines at the rate of £1 a month, he doubted if these proceedings would have any effect. Only last year, during the Local Government Board inquiry at Hackney, Mr. Balfour Browne, on behalf of the London County Council, twitted the Company with not putting in force the very Act under which the defendants had been convicted; and Mr. Pember, who represented the Company, then stated that the Magistrates would not fearlessly carry it out.

Mr. CLUER (laughing): That was before I was appointed.

Mr. KEBBELL said he did not refer to any particular Magistrate; and he knew that what had been done was simply out of sympathy with the persons summoned. But if they were allowed to pay at pleasure, legal proceedings would be quite worthless. It was a serious thing to waste 2000 gallons of water a day for two years. Considering the wicked nature of the offence, he raised his protest against the carrying out of the suggestion that had been made.

Mr. CLUER repeated that he thought the matter ought to be a deterrent to other people. But if the payments of £1 a month were not kept up, there was, of necessity, the other alternative.

Mr. DEAKIN said he had explained this to the applicants, and had pointed out to them that it was simply a matter of grace.

Mr. KEBBELL: It is no act of grace on my part. I would not give them a minute.

The Legal Status of Automatic Prepayment Meters.

The Gaslight and Coke Company are resolved, if possible, to get an authoritative ruling in respect of the legal status of the coin-freed gas-meter; and when William Herrick, of Battersea, was charged on remand at the South-Western Police Court, a few days ago, with attempting to steal some money from an automatic prepayment meter, Mr. Humphreys, as representing the Company, urged this determination as a reason why the accused should be committed for trial. It appeared that Herrick, while intoxicated, broke open the meter for the purpose of purloining the coins which had been deposited as prepayment for gas; but as these had been removed that day, the money drawer was empty. Mr. G. L. Denman, Q.C., the Stipendiary, pointed out that it was rather unsafe, as well as curious, to charge a drunken man with stealing that which did not exist; and he advised the Company to proceed with a case of wilful damage instead. Mr. Humphreys said the Directors had carefully considered the case, and asked that the accused should be committed for trial on the charge of felony, since the Company were most desirous of having the legal aspect of the case settled. Mr. Denman said he had no objection to do this; but he did not think the case would reach the time for the arguments of Counsel. Mr. Humphreys said he knew there was danger that the Grand Jury would throw out the bill; but, under the circumstances, the Company were prepared to chance this possibility. The accused was then committed for trial: and if the Grand Jury find a true bill, a very interesting legal point will come before the Judge.

Heavy Penalty for Misappropriating Water at Birmingham.

At the Birmingham Police Court last Tuesday, Harry C. Davies, a builder, of Small Heath, was summoned for using water the property of the Birmingham Corporation for other than domestic purposes; he not having agreed with the Corporation for the supply of water for manufacturing use. The facts of the case were laid before the Court, on behalf of the Corporation, by Mr. M'Cardie. The defendant, it appeared, occupied premises at Green Lanes, Small Heath; and he was the Manager of the Bordesley Green Brick-Works Company. From the defendant's private premises, there ran a drain to the works; and it was shown that water was conveyed along this from the house to the works. The works had been occupied since 1888 and a water-meter was placed there, and rent (averaging about £30 14s. per annum) had been paid for the water used for manufacturing. On Jan. 7 this year, at the defendant's request, the supply for other than domestic purposes at the brick-works was cut off; and the meter was removed. This seemed (said Mr. M'Cardie) to be the first step towards carrying out the intention which defendant had formed of deliberately defrauding the Corporation. On July 17, two police-constables heard

the dripping of water somewhere in the brick-works. They entered, and found water running into a clayhole. An investigation followed; and the water was traced along a drain, which led to the tap in the yard at the defendant's house. Attached to the tap, and, apparently, in order to deaden the sound, was a piece of cloth down which the water ran to the ground. On July 27 an inspector from the Corporation Water Department went to the house and saw the water running. The defendant's attention was called to it; and he at first said it was waste water that was flowing into the clay-pit. But it was pointed out to him that the tap was running at the rate of from 1100 to 1500 gallons per hour. Defendant afterwards admitted that he was doing wrong, and said he was exceedingly sorry. On Aug. 2, however, the water was found running again as badly as ever; and this time defendant had adopted a new method for deadening the sound of the dripping. A bucket had been fixed close to the nozzle of the tap—the mouth of the tap was under water—and the bucket hung inside a tub, which was slanted so that the water might overflow and pass off to the drain. The water was running on July 20 and on Aug. 2, 6, and 7. On the latter date, Davies admitted that he turned on the water to wet the clay; thus deliberately using the water for manufacturing purposes. If the waste had not been detected, it would have resulted in an enormous expense to the town. Corroborative evidence having been given, Mr. Dorsett, for the defence, made the strong assertion that what defendant had done was perfectly straightforward and above-board. He found himself in circumstances which compelled him to take Corporation water; and he was not unmanly enough to deny it. The water was cut off because it was found to be expensive, costing as much as £52 in 1894. Davies conceived the idea of sinking a well to supply the water. It was finished at the end of 1895; and he then no longer had occasion to use the water of the Corporation. He thought the well would supply him with sufficient; but in consequence of the dry season, he was compelled to use the Corporation water. Mr. Dorsett, however, failed to explain why defendant did not communicate with the Water Department before he was accused of misappropriating the water. For the offence on July 17, defendant was fined £5 and costs; and a similar penalty was imposed for offences on July 27 and Aug. 2. A fine of £1 and costs was imposed for the offence on Aug. 6; and no evidence was offered in respect of the offence on Aug. 7. The total penalties amounted to £16 and costs.

The Pollution of Rivers.

A correspondent has sent the following communication to "The Times": "An action was recently brought in the County Court of Andover, by Mr. William Fowle and others, riparian and mill owners, as aggrieved persons under the Rivers Pollution Prevention Act, 1876, against the Andover Town Council, for an order requiring the Council to abstain from causing or knowingly permitting sewage matter to fall or flow or to be carried into the River Anton along any channels or drains under the Council's control in, at, or about the borough of Andover. This was one of the rare cases where private individuals have taken action under the Act. The case was heard before his Honour Judge Gye on the 10th, 24th, and 25th of July; and he reserved judgment. On Aug. 21 he gave judgment, the effect of which was that the plaintiffs were persons aggrieved within the meaning of the Act, and that they had the ordinary right of riparian owners to have the flow of the stream come to them unpolluted; that the Andover Town Council had knowingly permitted the sewage to fall into the stream; that there was serious pollution of the river; that the Council had not used any means of rendering harmless the sewage so falling into the stream; and that they were able to prevent the sewage flowing into it. The Judge stated that he had seen the river, and had no hesitation in saying that its state was very bad; and he granted an order requiring the Corporation to abstain from polluting it—suspending the operation of the order until Oct. 31, with liberty to either party to apply on Oct. 23, when he would exercise his discretion as to whether or not he would further suspend the order, as to which he would be guided by seeing if any operations or negotiations were on foot to remedy the evil. He gave the plaintiffs costs on the higher scale, and the costs of the shorthand notes and of expert evidence."

Sheffield Corporation Water Supply.—An important Local Government Board inquiry was held at Sheffield last Friday by Colonel Hasted; the Corporation having applied for sanction to the borrowing of nearly a quarter of a million of money. Only a comparatively small amount was required for the Water Department—viz., £19,541—and, in regard to this, it was stated by the Chief Engineer (Mr. E. M. Eaton) that the money was wanted for works to be carried out by March next. The Damflask reservoir was, he added, nearly completed. It was partially filled with water; and the work of pitching was being proceeded with. A portion of the loan was needed to cover this expenditure.

Perth (Western Australia) Gas Company.—The net profit realized by this Company in the year ending May 31 was £6094, after deducting £276 for the loss on the electric lighting branch of the business. This amount, with the balance of £1403 brought forward, made up £7497, out of which the Directors recommended the payment of a dividend at the rate of 5 per cent. for the half year, with a bonus at the rate of 2½ per cent., which with the interim dividend of 5 per cent. paid for the half year ended Nov. 30, 1895, absorbed £2500. They also advised the transfer of £3000 to the reserve fund—increasing it to £10,000; and the carrying forward of the balance of £1997. In order to meet the increased business of the Company the Directors, in September last, deputed the Manager—Mr. E. Wigglesworth—to proceed to England with instructions to purchase extra plant for the production of both gas and electricity. These purchases were completed with every satisfaction to the Board. The erection of the new machinery is being pushed forward; and when finished it will enable the Company to treble the quantities supplied with the present plant. The Directors recommended a reduction of 10d. per 1000 cubic feet in the price of gas, with a discount of 10d. if paid on or before the 15th of the month; practically bringing the figure down to 10s. per 1000 cubic feet.

MISCELLANEOUS NEWS.

THE GAS AND WATER ORDERS OF THE PAST SESSION.

The Board of Trade report on their proceedings under the Gas and Water Works Facilities Act, 1870, during the past session, was issued last week. It states that in December, 1895, fourteen applications for Provisional Orders were made to the Board—six relating to gas, and seven to water undertakings, and one to a combined gas and water undertaking. Power was sought to raise £205,800 by shares and £88,700 by loans, whereof £96,800 of share and £61,460 of loan capital related to gas undertakings, and £109,000 of share and £27,250 of loan capital to water undertakings.

The applications for Gas Orders were in respect of the following places: Chester-le-Street and Pelton, Fort William, Maidstone, Matlock Bath, Oswestry, and Settle. The application of the Maidstone Gas Company was the only one made in respect of an undertaking already authorized by Parliament. The Company applied for power to raise additional capital by the issue of debenture stock. The remaining five applications were for power to maintain and continue works already existing without parliamentary authority. Objections were lodged against most of the applications; and in consequence of the opposition of the Corporation of Oswestry, the application for the Order relating to that town was withdrawn by the promoters. With this exception, the Board of Trade granted an Order in each case, subject to certain modifications and amendments. The Board directed local inquiries to be held with respect to the applications for the other Orders.

In the case of the Chester-le-Street and Pelton Order, the consents of some of the local and road authorities interested were not obtained; and the promoters requested the Board of Trade to dispense with such consents. The Board appointed Lieut.-Col. Yorke, R.E., to hold an inquiry, and to report to them on the matter. Upon consideration of his report, the Board decided to grant an Order; and, in compliance with section 4 of the Act, under which they exercise their powers, they made a special report to Parliament thereon. The following local and road authorities were interested: The Chester-le-Street Parish Council, the Pelton Parish Council, the Chester-le-Street Rural District Council, the Durham County Council, and the Durham and Chester-le-Street Highway Board. Their principal objection to the Order was in regard to the price proposed to be charged for gas. Colonel Yorke reported that, having considered with much care the evidence placed before him, he was strongly of opinion that it would be for the public benefit if the supply of gas to the townships in question were in the hands of a Company having statutory powers and with statutory obligations. Subject, therefore, to a proposed modification of the maximum price, he recommended that the Order should be granted; and the Board decided to give effect to his recommendation by substituting a standard price of 2s. 9d. per 1000 cubic feet, with a sliding-scale, for the proposed maximum of 5s. per 1000 cubic feet.

The application with respect to Fort William was for power to maintain and continue gas-works already in existence. Objection was made by the Commissioners of the Burgh of Fort William to the granting of an Order, on the ground of the unsuitability and inadequacy of the site of the works, the inefficiency of the existing supply of gas, and for other reasons. Colonel Yorke held an inquiry at Fort William, and reported that, in his opinion, the situation of the works was undesirable, and that the area of the site was inadequate; and he suggested that the Order should be withheld until a more suitable site had been selected. After consideration of his report, and having regard to the desirability of placing the gas supply under statutory restrictions, the Board decided to grant an Order, but to insert a clause empowering the Commissioners, by notice served on or before July 31, 1896 or 1897, to require the undertakers to apply to Parliament or to the Board of Trade, in the then next ensuing session of Parliament, for authority to manufacture gas upon a new site in lieu of the existing one, and providing that, if the undertakers failed to obtain the necessary powers, those conferred by the Order should cease and determine on the expiry of two years from the date of the service of the requisition by the Commissioners. The Board further inserted a clause empowering the Commissioners to purchase the undertaking at any time within five years from the commencement of the Order.

In the case of the application for the Matlock Bath Order, which proposed to authorize the maintenance and continuance of existing gas-works and the extension of the area of supply, objections were lodged on behalf of the Matlock Bath and Scarthin Nick Urban District Council. The Board of Trade appointed Lieut.-Col. Addison, R.E., to hold an inquiry with respect to the application. He reported that the objections of the Council were mainly confined to the following points—viz., that the Council were themselves promoting a Bill for the acquisition of the undertaking of the applicants for the Order (the Matlock Bath Gas Company), and that the financial clauses of the Order were objectionable. He recommended that a clause should be inserted providing that, if the Council obtained powers for the purchase of the undertaking, the price to be paid for it should not be increased by reason of the issue of the Order; and that certain modifications should be made in its provisions relating to capital, dividend, and the price of gas. Subject to these recommendations, he was of opinion that the Order should be granted. After consideration of the report, the Board decided to grant the Order, and to give effect to the recommendations. The Order was made and scheduled to a Confirming Bill; but the District Council having obtained their Act for the purchase of the undertaking, the Order was not proceeded with.

The application for the Settle Order was objected to by the Settle District and Parish Councils; and Lieut.-Col. Addison held an inquiry into the matter. He recommended that the Order should be granted subject to certain modifications, and to the insertion of a clause providing for the sale of the gas undertaking to the District Council, in the event of that body obtaining the necessary power to purchase before Jan. 1, 1898, and calling upon the Company to sell. The Board

decided to grant an Order, and to give effect to the Inspector's recommendations.

The sliding-scale was adopted in the Chester-le-Street and Pelton Order; the initial price being fixed at 2s. 9d. per 1000 cubic feet. In the following Orders, the maximum prices stated were fixed; power being reserved to the Board to vary it, or to substitute a sliding-scale, after three years (two years in the case of the Matlock Bath Order): Fort William, 7s.; Matlock Bath, 3s. 8d.; and Settle, 4s. 7d. The sale of gas in bulk beyond the area of supply, subject to the usual limitations, was authorized in the Fort William and Matlock Bath Orders. The Orders also contain the usual clauses as to the sale of additional capital by auction or tender, limits of dividend, the creation of insurance and reserve funds, illuminating power, testing of gas, the quantity of land to be taken by agreement, &c., and, where necessary, the Gas-Works Clauses Acts, 1847 and 1871, are incorporated.

The single application for a combined Gas and Water Order came from the Laindon Gas and Water Company, Limited, who sought authority to construct and maintain new gas and water works, and to make and sell gas and to supply water within the parishes of Laindon Hills, Lee Chapel, Laindon, Little Burstead, and Great Burstead. The promoters failed to obtain the necessary consents of the local and road authorities in respect of the parishes of Laindon Hills, Lee Chapel, and Great Burstead; and these parishes were therefore struck out of the limits of supply. Subject to modification and amendment, the Board decided to grant an Order applicable to the remaining parishes. A maximum price of 5s. per 1000 cubic feet of gas was authorized; power being reserved to the Board to vary the maximum or to substitute a sliding-scale after three years. The Company were also empowered to supply water in bulk by agreement within or beyond the limits of supply.

Two Bills to confirm the Gas and Gas and Water Orders were introduced into the House of Commons on the 4th of May. The Matlock Bath Order was opposed. But the Order was withdrawn, for the reason above stated; and the Bills passed without opposition. The Gas Provisional Orders Bill received the Royal Assent on the 2nd of July, and the Gas and Water Provisional Orders Bill on the 20th of that month.

The applications for Water Orders were in respect of the following places: Amersham, Beaconsfield and district, Ampthill, Burnham and district, East Huntingdonshire, Hemel Hempstead, Maidstone, and Tilehurst, Pangbourne, and district. Two of the applications proposed to authorize new undertakings; and two others, the maintenance and continuance of existing work. The remaining three were for authority to raise additional capital, or extend the limits of existing companies. The Ampthill application, which was in respect of a new undertaking, was not proceeded with; but in all the other six cases, Orders were granted with or without modifications.

The East Huntingdonshire application was opposed by several of the local and road authorities concerned; and, on the application of the promoters, the Board appointed Lieut.-Col. Yorke to hold an inquiry. On consideration of his report, the Board decided to strike out all the provisions relating to new works and extension of limits, and to confine the Order to provisions authorizing the issue of £10,000 of preference shares or stock, in lieu of the same amount of ordinary capital authorized by the East Huntingdonshire Water Act, 1887.

The Hemel Hempstead application was opposed by the Hemel Hempstead Parish Council, and a local inquiry was held by Lieut-Col. Yorke, who reported that, subject to certain reductions which he suggested in the maximum charges, to the insertion of a clause providing for the purchase by the Local Authority, and to certain other minor amendments, he was of opinion that the Order should be granted. Acting upon these recommendations, the Board decided to dispense with the consent of the Council; and they made a special report to Parliament on the matter.

A Bill to confirm the Water Orders was introduced in the House of Commons on the 4th of May. A petition was lodged against the Tilehurst Order on behalf of the Thames Conservancy. The *locus standi* of the Conservators was, however, disallowed by the Court of Referees. The Conservators renewed their opposition in the House of Lords; but their *locus standi* was again disallowed. The Bill received the Royal Assent on Aug. 7.

The total number of Orders made by the Board since the passing of the Act is 413, of which 406 have been confirmed by Parliament.

PROVINCIAL GAS AND WATER COMPANIES.

Gas Companies.

In the report presented to the shareholders of the Bath Gas Company at their meeting last Friday, the Directors stated that there had been a slight decrease in the gas-rental and a large decrease in the receipts for coke in the six months ended June 30. This was accounted for by the extreme mildness of the season as compared with the severe weather of the corresponding period of last year. The sale of gas to private consumers produced £23,121; public and contract lighting, £2487; residuals brought in £4388; and the total receipts were £31,316. The expenditure on the manufacture of gas amounted to £19,078; on distribution, to £2203; rates and taxes came to £1172; management cost £1479; and the total expenditure was £24,592—leaving £6724 to be carried to the profit and loss account. The balance available for division was £20,257; and the Directors recommended the declaration of maximum dividends. With regard to working, under the supervision of Mr. C. Stafford Ellery, there were 18,682 tons of coal and 50,252 gallons of oil used in the manufacture of gas; the residuals produced being 4345 tons of coke, 1075 tons of breeze, 117 tons of tar, and 628,000 gallons of ammoniacal liquor. There were 295 tons of sulphate of ammonia in store at the close of the past year, and 204 tons were made in the six months covered by the accounts; 280½ tons were sold, and 218½ tons left in store.

The Directors of the Brighton and Hove Gas Company will report, at the meeting of shareholders on the 11th inst., a falling off in the revenue in the six months ending June 30—first, in consequence of the effect upon the rental of the reduction in the price of gas which came into operation on the 1st of January; secondly, owing to a decreased sale of gas caused by the very mild season; and, thirdly, from a considerable fall in the value of residuals. With these exceptions, the operations of the half year are satisfactory. The sale of gas brought a revenue of £63,175; and the rental of meters and fittings, £2362—together, £65,537; residuals produced £13,275; and the total receipts were £78,981. The manufacture of gas cost £42,869; its distribution, £6928; the expenses of management were £4027; and the total expenditure was £57,777—leaving a balance of £21,204. The amount available for division is £30,456; and the Directors recommend the declaration of dividends at the rates of 11½, 8½, and 6 per cent. per annum upon the various classes of stock. This will absorb £23,025, and leave a balance of £7431 to be carried forward. A sum of £8855 was expended on capital account during the past half year; £4313 being for new mains and services, and £2469 for new meters and fixing them. Out of the £618,079 of capital raised, £600,414 has been spent—leaving a balance of £17,656. Under the supervision of Mr. J. Cash, M.Inst.C.E., the Company's Engineer, 37,736 tons of common coal and 322 tons of cannel were carbonized, and oil and spirit equal to 2675 tons of cannel used, in the half year. Of the total bulk of gas made, 447,931,500 cubic feet were sold for private and public lighting; and the following are the estimated quantities of residuals: Coke, 49,453 chaldrons; breeze, 2815 tons; tar, 507,146 gallons; ammoniacal liquor, 893,007 gallons. Of the first-named residual, nearly 11,000 chaldrons were used in manufacture. The Directors state that the carburetted water-gas plant at Portslade has been in use for the greater part of the half year, with results fully equal to those anticipated.

The report of the Colchester Gas Company for the past half year shows that there was received for gas £8702; meter-rents, £98; coke, £1417; tar, £421; and sulphate, £248—the total receipts amounting to £10,927. The expenditure (including £4600 for coals) amounted to £8742, there being a balance of receipts over expenditure of £2185. The profit and loss account shows that there has been paid for dividends £1910, and for interest £184, while on the credit side there is a balance of £11,234. The sum of £2185 has been brought from the revenue account, and £83 interest from the reserve fund; thus leaving a balance of £11,408. A dividend has been declared at the rate of 10 per cent. per annum (free of income-tax) on the original shares, and of 7 per cent. on the new shares.

At the half-yearly general meeting of the Cork Gas Consumers' Company last Thursday, the accounts presented showed a decreased consumption of gas in the six months ending June 30, as compared with the corresponding period of 1895, but a fair average increase over that of the Midsummer half of 1894. As in the cases of other companies whose operations have lately been noticed in these columns, the comparatively low consumption for the past half year is accounted for by the exceptionally fine bright weather which prevailed during most of the time, whereas the spring and early summer of 1895 were particularly dull and dark. The gas rental amounted to £18,761; residuals produced £5725; and the total revenue was £24,504. The expenditure was £17,302; leaving £7202 to go to the profit and loss account. The Directors remarked in their report, that the residuals showed a good return, taking into consideration the fact that the price obtained for sulphate of ammonia was the lowest on record. The sulphate of ammonia plant, which has been in use for about twenty years, is now entirely worn out; and it is to be replaced by more modern apparatus. The cost of this will be charged to the depreciation fund, which has been credited with £500. The balance available for distribution was £5658; and to pay the usual dividend, £5652 was required. The small balance was added to the reserve fund. The Resident Engineer (Mr. T. Travers) reported that an ample supply of gas had been delivered from the works during the half year, and that the initial pressure had to be increased in the daytime in order to meet the growing demand for gas for motive power and other non-illuminating purposes. Two of the retort-houses are undergoing repair, which will put them into a condition to meet the coming winter's demand. The adoption of the report was moved by the Chairman (Mr. G. Lynch); and the motion was carried unanimously.

The meeting of the Eastbourne Gas Company was held yesterday week—Dr. G. A. Jeffery in the chair. The Directors reported a profit of £5913 on the working in the six months ending June 30, which, added to £10,664 brought forward, and a sum of £115 received for interest, made a total of £16,692 available for distribution. They recommended dividends at the rates of 14 and 11 per cent. on the several classes of shares, which would absorb £5849, and leave £10,843 to be carried forward. In moving the adoption of the report, the Chairman referred to the effect on the consumption of gas of the bright weather of the past half year, as compared with the inclement and ungenial season early in 1895, and to the loss sustained by the Company upon their residuals, especially coke and sulphate of ammonia—the low prices of the latter being a cause of complaint by most gas companies. Notwithstanding these drawbacks, however, the Company had earned, and fairly earned, a profit that enabled them to pay the full dividend. This, he thought, was very satisfactory. It had been done by observing a rigid economy and careful management; and he thought it did credit to all concerned, more especially to their Manager (Mr. R. Hammond), who had taken a deep interest in their affairs, and had done his very utmost to further the interests of the concern. In giving some statistics, the Chairman said they had lost under the heading of residuals, as compared with last year, £713; but this was just counterbalanced by savings in other directions. The make of gas had been 107,512,000 cubic feet, as compared with 111,906,000 cubic feet in the corresponding six months of 1895; while the leakage was only 2·6 per cent. The Directors had purchased from the Duke of Devonshire some land adjoining their works, which would prove ultimately of great advantage. With the sanction and assistance of the Brighton Railway Company, they were about to lay down a new line, with siding, to a length of 300 yards, which would be a great convenience, and effect a considerable saving in labour. Mr. Farncombe seconded the motion; and it was carried unanimously. The dividends recommended were declared; and the proceedings closed with votes of thanks to the Chairman and Directors, as well as to the Manager.

Next Thursday, the Directors of the Hastings and St. Leonards Gas Company will present to the shareholders their report on the working of the undertaking in the six months ending June 30. The price of gas was reduced at the beginning of the year to 3s. per 1000 cubic feet; and, as anticipated, the gas rental has been thereby diminished; while the sale of gas was, of course, retarded by the mild weather. However, the accounts show receipts to the amount of £23,106 for private lighting, and £3121 for gas supplied to the public lamps and under contracts—together, £26,227. Residuals produced £6381, compared with £6501 in the preceding half-year; and the total revenue is £34,111. The expenditure on the manufacture of gas amounted to £20,014, of which £13,156 was for coals and £2015 for duty paid thereon to the Hastings Sanitary Authority; distribution cost £1579; management, £1226—the total expenses being £24,445. The balance carried to the profit and loss account is £9666. The price of gas having been reduced 2d. per 1000 cubic feet, the Directors recommend the payment of dividends, under the sliding-scale, at the rates of 13 and 10 per cent. per annum, for which there is a good balance available. With regard to the works, which are under the supervision of Mr. Charles E. Botley, Assoc.M.Inst.C.E., considerable progress has been made with the erection of oil-gas plant; and it is hoped that it will be at work during the coming winter. The number of automatic prepayment meters (penny and shilling) now fixed is 1000; and the number of cooking and heating stoves on hire is about 3000. There were 16,615 tons of coal and 315 tons of cannel carbonized in the six months covered by the accounts; and 174,780,000 cubic feet of gas were made. Of this quantity, 168,528,200 cubic feet were sold, and 170,276,000 cubic feet accounted for. The estimated production of residuals is: Coke, 10,384 tons; breeze, 667 tons; tar, 158,302 gallons; and ammoniacal liquor, 335,105 gallons.

Moving the adoption of the report and accounts—noticed last week—at the recent annual meeting of the Heckmondwike Gas Company, the Chairman (Mr. Joseph Stead) congratulated the shareholders on the continued increase in the consumption of gas. He also stated that it had been anticipated that, in consequence of reductions in price, there would be a loss of about £700; but instead of this the receipts had been £13,061, as against £13,048 in the preceding year. The increased consumption was attributed to the general improvement in the trade of the district. Their shares were fetching a higher price in the market than they had ever previously realized; buyers being satisfied to get 3¾ per cent. on their investments. The full statutory dividends were declared on all the shares; and the balance to be carried to this year's account is £1574. The reserve fund stands at £6300.

The fact that only seven shareholders attended the half-yearly meeting of the Kingston-on-Thames Gas Company on the 20th ult. showed that the general body had faith in the Directors. Mr. P. Jones presided, and, in moving the adoption of the report and accounts, briefly alluded to the approaching completion of the new gasholder, the erection of which has gone on in a manner most satisfactory to the Directors and their Engineer (Mr. H. F. Packham). He congratulated the shareholders on the fact that the profits made in the past half year more than sufficed to pay the maximum dividends, which was a better position than that occupied by some companies. A question as to the falling off in the returns for residual products elicited the information that it was not due to a reduction in the output, but to the great drop in the price of both coke and sulphate of ammonia. The latter had, he said, gone down from £22 to £7 per ton; and coke had never been so cheap. The report was adopted; and a vote of thanks was passed to the Directors, the Engineer, and the Secretary (Mr. J. A. Fricker).

The annual meeting of the Maidstone Gas Company was held last Thursday—Mr. A. Warde presiding. The accounts showed a balance in favour of the Company of £13,303; and a dividend at the rate of 11 per cent. per annum, less income-tax, was recommended. The business of the Company continues to increase. After the payment of the dividend, there would be about £230 to strengthen the reserve. The recommendation was adopted.

The profits of the Normanton Gas Company for the past half year amounted to £953; making the sum available for division £2950. A dividend at the rate of 10 per cent. per annum has been declared, after paying which £1950 will remain to be carried forward.

The annual meeting of the Salisbury Gas Company was held on the 19th ult.—Mr. G. Fullford in the chair. The Directors, in their report, stated that, notwithstanding the reduction of 1d. per 1000 cubic feet in the price of gas, and the prevalence of clear dry weather in the past six months, which was not favourable to the sale of coke, the receipts were only slightly below those of the previous year. The profit and loss account showed that the net profit for the year was £2769. The balance brought forward was £358, from which £25 had been carried to the reserve fund; leaving £107. The half year's dividend paid in February absorbed £1260; leaving £1616 available for distribution. The revenue account showed receipts amounting to £15,220, as compared with £15,903 in the previous year; and expenditure, to £12,079, against £12,778. The cost of manufacture was reduced from £10,239 to £9747; of distribution, from £954 to £813; and allowances and bad debts, from £227 to £193. In moving the adoption of the report, the Chairman remarked that, though the income from the sale of gas was slightly less than in the previous year (£11,862 against £12,194), there was a marked improvement in the expenditure. The Manager (Mr. Norton H. Humphrys) had advised the Board that one of the advantages that would ensue from the erection of the new holder would be a considerable saving in the working expenses; and this had been proved to be correct, as seen by the cash in the bank. Altogether, the accounts were highly satisfactory, and showed that the business was in a sound condition. Mr. S. Griffin, in seconding the motion, also referred to the economy in working effected by the Manager. He likewise expressed his pleasure at seeing at last a cheap gas-engine placed upon the market; having that morning witnessed one at work which cost only £7, and which was capable of running any hand machine. The motion was carried. A vote of thanks having been accorded to the Chairman, Directors, Auditors, Secretary, and Manager for their services, the Chairman spoke highly of the Manager and the staff generally, and said the Directors were thoroughly satisfied with the way in which the duties were discharged. He also alluded to the services rendered by the Secretary (Mr. A. Whitehead), who had, he said, held the office for several years, and proved a most useful and efficient officer. Mr. Whitehead and Mr. Humphrys having acknowledged the compliment, the proceedings closed.

The gross receipts of the Sevenoaks Gas Company last half year amounted to £5421; and the expenditure, to £3653—the profit being £1768. The amount available for division is £3394; and out of this dividends of 10 and 7 per cent. are to be paid. The Company's business is extending in connection with the prepayment meter system and the letting on hire of gas cooking stoves. They have now in hand the renewal and enlargement of one of the old gasholders; and several beds of retorts are being reconstructed.

The Directors of the Sunderland Gas Company, like those of similar undertakings, attribute to the exceptional mildness of the weather which prevailed in the first portion of the year, the check that has been experienced in the natural increase in the consumption of gas; yet in the report which they will present to the shareholders to-morrow they state that the receipts from the sale of gas in the year ending June 30 augmented by £1063. This, however, has been more than absorbed by the decrease of £1270 in the price received for residuals. The total revenue from all sources was £83,788; and the expenditure, £66,573—leaving a balance of £17,215. An interim dividend was paid in March; and the Directors recommend a similar one of 5 per cent. on the original stock and 4¼ per cent. on the additional capital.

At the recent ordinary general meeting of the Warminster Gas Company, the Directors presented a report showing a profit of £719, of which £609 is to be distributed in the payment of a dividend of 7 per cent.

The half-yearly general meeting of the Wolverhampton Gas Company was held last Tuesday—Mr. H. Ward in the chair. The accounts presented showed a net profit to the 30th of June of £7616. This added to the balance brought forward made up £7979, out of which the Directors in their report recommended the payment of dividends at the rate of 3 per cent. upon the preference stock, 5 per cent. upon the consolidated stock, and 3 per cent. upon the new ordinary stock, less income-tax. In moving the adoption of the report, the Chairman remarked that the past half year appeared to be unusually bad compared to the extraordinary winter of 1895; and therefore it was fairer to put it against 1894. Compared with the former period, the income was smaller by £1723; but with the latter, an increase of £1100. This showed that they were turning the corner after the reduction of 3d. per 1000 cubic feet in the price of gas. Every 1d. per 1000 cubic feet meant to the Company a sacrifice of £2000; so that a reduction of 3d. was really a gift of £6000 to the consumers. The reserve fund amounted to £5887. The Company had laid out a considerable sum in new retorts, but thereby they were able to increase the make of gas to the extent of 50 per cent.; and they believed they were thoroughly prepared for the coming winter. They had also made very favourable contracts for coal for the next twelve months. The report was adopted. Mr. H. Owen, in proposing a vote of thanks to the Directors, expressed the belief that the Company would be able to compete satisfactory with the electric light. Mr. C. Fellows, in seconding the motion, protested against the action of the Corporation in introducing the light. If, he said, any private company had started, they would have had no ground to complain; but he thought it very hard, and contrary to all principles of justice, for the Corporation to set up in opposition to the Company, and virtually with the Company's money. He did not dread the interference of the electric light; but he thought it would prove for the town a disastrous failure, and they, as shareholders and citizens, should protest against it, because it was Socialism disguised. The motion having been carried, the Chairman, in returning thanks, observed that he did not think the Company had suffered by the introduction of the electric light. No doubt the Corporation had taken the best part of the town, and driven the Company more into the suburbs; but they had some compensation, and no cause to fear. Gas-engines were being used in large numbers, and were on the increase every day. There was also a great deal of cooking done by gas. The summer had been an exceptional one—light days and dry weather—so that the consumption of gas had been less. But with the present half year an increase had set in; and the Directors had hopes of this continuing.

Water Companies.

At the recent meeting of the Cromer Water Company, a dividend of 5 per cent. was declared for the past financial year; carrying forward £82. On the advice of the Company's Engineer (Mr. J. C. Melliss, M.Inst.C.E.), the Directors have during the last few months driven 400 additional adits in the chalk in connection with one of the wells. The work was carried out by Messrs. Tilley and Sons, of Walbrook, the contractors for the wells; and it has resulted in a largely increased yield of water. The Directors have undertaken to supply the Suffield Park district, recently transferred from Overstrand to Cromer; and also, under a guarantee from the Erpingham District Council, the village of Overstrand. The Company's reservoirs now afford storage for 730,000 gallons of water.

Last half year the East Worcestershire Water Company connected to their mains 130 additional services; making the total 4033, exclusive of Droitwich and Rednal. The water pumped averaged 567,592 gallons daily. Extensions of the plant have been made, with the result that the Company have now at command a supply of more than a million gallons a day. The profit for the half year is £1183, which, added to £1415 brought forward from last account, makes a disposable balance of £2599. At the meeting of the shareholders last week, it was agreed to pay a dividend of 3 per cent. for the twelve months, to add £624 to the depreciation reserve fund, and to carry forward £132.

At the half-yearly meeting of the Kettering Water Company yesterday, the Directors reported that the revenue account showed a balance of £1489 on the working in the six months ending June 24; the receipts being £140 more than those in the corresponding period of 1895. After paying all the working expenses and the interest upon the debentures, there was a balance of £1456 on the profit and loss account, including £303 brought forward. The Directors recommended the payment of an interim dividend at the rate of 6¼ per cent. per annum on the "A" capital, and at the rate of £4 6s. 8d. per cent. per annum on the "B" capital, both free of income-tax; being the same rate of interim dividend as that paid for the corresponding half of last

year. This absorbed £1177, and left a balance of £279 to be carried forward. The Manager (Mr. T. A. Simpson) reported that the works of the Company were in good order, and that an excellent supply of pure water had been distributed throughout the district; also that, notwithstanding the great quantity run to waste, the water in the Cransley reservoir had never fallen 15 inches below its highest level, or had less than one year's supply therein during the six months.

At the recent half-yearly meeting of the Leatherhead and District Water Company, the Directors reported that the receipts for the six months ending June 30 amounted to £1550—being £201 in excess of those for the corresponding period of 1895, and £382 more than in that ending June, 1894; while the working expenses, including the cost of lowering mains and clearing off the balance of the suspense account, came to £1040, leaving a profit of £510. To this must be added £285 brought forward; making a total of £795. Deducting £125 for interest on debenture stock, there remained £670 available for division. This would suffice to pay a dividend at the rate of 2½ per cent. per annum, which the Directors recommended, and leave a balance of £356. The Engineer (Mr. F. Mead) reported that the work of lowering the mains affected by the severe frost of last year had been completed. In all, about 5300 yards of mains had been dealt with at a cost of about £408. The Chairman (Mr. H. Rokeby Price), in moving the adoption of the report, stated that, during the half year 29,879,000 gallons of water were pumped, against 28,652,000 gallons in the corresponding period of 1895—an increase of 1,227,000 gallons; while the cost of fuel had decreased by upwards of £18. The cost of fuel per million gallons had been £2 8s., as compared with £3 5s. 1d. for the same period of 1895. If they went back four years, and took the corresponding half of 1892, they would find they then pumped only 14,150,000 gallons, or not quite half the quantity they raised in the past six months; and the cost of fuel was £96 12s. 8d., compared with £71 11s. 7d. now—thus showing that, while the number of gallons pumped had been doubled in four years, the cost of fuel had been reduced by about £25. This benefit had been secured partly by using coke instead of steam coal, and partly by the economical working of the new Worthington engine. The report was adopted; and the dividend recommended was declared.

The annual general meeting of the Maidstone Water Company was held on the 20th ult.—Mr. Charles Ellis in the chair. In moving the adoption of the report, the Chairman said the undertaking was making steady progress. The earnings for the past six months amounted to £4889; while the accounts showed a sum of £5850 to be carried to profit and loss. These were facts which he thought were exceedingly gratifying. Another reason for gratification was that the Company had obtained powers authorizing them to borrow £12,000 on ordinary shares or stock, and £3000 on mortgage. The Directors recommended the payment of a dividend of £4 1s. 8d. per cent. on the 10 per cent. shares, and £2 16s. 8d. per cent. on the 7 per cent. shares. These payments would absorb £1822. The report was adopted.

The chief figures in the half-yearly accounts of the South Staffordshire Water Company were published in the "JOURNAL" for the 11th ult.; but additional interesting particulars were furnished in the speech of the Chairman of the Company (Mr. Frank James) at the meeting of shareholders last Thursday. He stated that they had added 1500 houses to their system during the six months; the total number now supplied being nearly 90,000. It was a matter of great satisfaction that that day they touched a point in their capital account which had never been reached before in the history of the Company. The preference and debenture stock of any company issued like theirs, after the payment of a dividend of over 5 per cent. for ten years, became stock in which trustees, under the Act of Parliament, were permitted to invest. It was called "gilt-edged" security. For twenty half years, including the last, they had paid a dividend of 5 per cent. and over; and after the adoption of the report and accounts that day, their debenture and preference stock became trustees' stock for the purposes of investment. With respect to the maintenance of works, they had spent £2733, as compared with £6813 in the corresponding half of the previous year, which indicated the immense cost to the Company of the long frost. The water charges for the half year amounted to £45,455, as compared with £42,551 in the corresponding period of the previous year. The sum for division was £20,064, against £15,956 in the corresponding period of last year. The Directors recommended the payment of a dividend which would absorb £15,817; leaving £4247 to be carried forward. The report was adopted; and dividends at the rate of 5 per cent. per annum on the preference stock, 4 per cent. on the Dudley water preference stock, and 5½ per cent. on the ordinary stock were declared.

New Issues of Capital.—The Maidenhead Gas Company are about to raise additional capital to the amount of £8000, in £10 shares, which will be entitled to a dividend of 7 per cent. per annum, and to borrow £3600 on debentures. The Gosport Water Company purpose issuing perpetual debenture stock to the amount of £2875 for carrying out improvements.

The Proposed Purchase of the Chichester Water-Works by the Corporation.—At a recent meeting of the Chichester Town Council, a discussion took place *in camera* on the reply of the Directors of the Chichester Water Company in respect of the proposal to municipalize the water undertaking. The Council, it appears, drafted an agreement; and the Company desired to amend certain clauses. This the Council will not agree to; and though the Mayor warned his colleagues that, in the event of their declining to meet the Company, the scheme would probably collapse altogether, the Council, by a majority of one, refused to accept the Company's amendments.

Illumination by Acetylene Gas.—The horticultural show and floral *fête* held in Lady Shelley's Park at Boscombe, Bournemouth, on the 19th and 20th ult., were illuminated, by means of acetylene gas, by Messrs. Thorn and Hoddle, of Camberwell. The four large marquees, each about 200 feet by 40 feet, were most brilliantly lighted with their patent "Incanto" generators. Twenty burners, each of about 60-candle power, were employed for each tent; and the light remained perfectly steady and smokeless all through. The general opinion was that it was superior to an installation of electric light, which would have cost ten times as much as the system employed.

MR. CHARLES HUNT ON THE LIVERPOOL GAS-WORKS.

In view of the reference made by the Chairman of the Liverpool United Gas Company, at the recent half-yearly meeting, to the result of the investigation conducted by Mr. Charles Hunt, M.Inst.C.E., at the request of the Corporation Lighting Committee into the Company's methods of working, it may be of interest to give the text of his report, which was shortly noticed in the "JOURNAL" for June 9 last.

Gas-Works, Windsor Street,
Birmingham, March 7, 1896.

To the Chairman and Members of the
Lighting Committee of the City of Liverpool.

Gentlemen,—I beg to report that, agreeably with your instructions, received through your Superintendent, Mr. C. R. Bellamy, I inspected the works and plant of the Liverpool Gas Company on the 25th ult., for the purpose of ascertaining, in the terms of the reference, (1) whether the works are properly equipped for manufacturing gas on the most economical principles; and (2) whether the carbonizing materials used are the cheapest for the candle power required. Mr. W. King, the Company's Chief Engineer, most courteously afforded me every facility for the inspection.

The works at Garston are of recent construction. They are solely for the manufacture of carburetted water gas; the plant being of American origin. They comprise four sets of generators, with superheaters, &c., washers, and condensers, each set capable, it is stated, of producing about 850,000 cubic feet of gas per 24 hours. They therefore represent, with the relief gasholder, exhausting, purifying, and measuring plant, a total productive capacity of about 3,400,000 cubic feet per 24 hours. The generating-house is of sufficient size for doubling the present number of generators when required. There are two oil-storage tanks, each capable of containing nearly 1100 tons of oil; the gas storage being represented by one three-lift gasholder of about 4 million cubic feet capacity.

There is a railway siding into the works, which are not only fully equipped, but are also well arranged with a view to economical working. They form, in fact, model works of the kind; the only drawback to them being the necessity for bringing from a distance the coke required for the manufacture. This, however, may be overcome by the erection of coal-gas plant, for which there is ample room; the site being said to cover about 35 acres. At the time of my visit, only one of the four sets of generators was in use; and the gas was being distributed, partly direct to the consumers, and partly through the nearest coal-gas works.

The Wavertree works are well arranged for a daily production of about two million cubic feet, and have a storage capacity of about 1,680,000 cubic feet. There is a railway siding into the works; but no communication with the canal. The retorts are contained in three houses of equal size, in one of which regenerative firing has been applied. All the work is done by hand. Purification is effected solely by oxide of iron. Gas is received here, and also at Caryl Street, from Garston, and mixed with the coal gas—not to enrich the latter, but simply for distribution.

The Caryl Street works have neither canal nor railway accommodation; and the coal has to be carted from a distance of about half a mile. They are capable of producing about one-and-a-half million cubic feet per 24 hours, but have storage for upwards of three million cubic feet, including a gasholder in an adjoining yard. The retorts are all direct fired; the work is done by hand; and oxide only is used for purification.

The Eccles Street works are used only during the winter months. They produce about 2,100,000 cubic feet per 24 hours, but have storage for only 950,000 cubic feet. They join the canal. The retorts are all direct fired; the work is done by hand; and oxide only is used for purification.

The Athol Street works also have canal accommodation. They produce about two-and-a-half million cubic feet per 24 hours; and when the extensions now in progress are completed, will have storage for about 2,800,000 cubic feet. The retort-houses, two in number, are what are termed "stage houses," having an upper floor, from which the retorts are drawn and charged, the coke falling into a cellar beneath. The retorts are all direct fired; the work is done by hand; and oxide only is used for purification.

The Linacre works are the largest and most modern of the coal gas works. Their productive capacity is estimated at about nine million cubic feet per 24 hours; and there is storage for a like quantity. They join the canal; and there is also a high-level railway siding into the works. Regenerative firing has been applied to many of the retorts, and is being extended to others; the settings being at the same time enlarged from six to nine retorts each. A commencement has also been made with stoking machinery; four Foulis hydraulic drawing-machines being in use. Arrangements are in progress for increasing this number, and for charging some of the retorts by the same system. Lime is used for purification.

In my opinion, the carbonizing arrangements of all the works are such as to secure a satisfactory yield of gas from the coal; and the washing and scrubbing plant is fully adequate for the complete removal of ammonia, which was for many years (and until quite recently) a very valuable bye-product. There is, however, room for improvement in the more extended application of gaseous or regenerative firing, by which a considerable saving in fuel and labour is usually effected over the ordinary system of direct firing, and which also secures a better heating of retorts. The Company also appear to me to be placed at a disadvantage by the small size of many of the retorts, which necessitates extra labour in drawing and charging, and by the comparative, and to a large extent enforced, absence of labour-saving appliances. At four of the works, these could hardly be introduced without extensive re-construction, in preference to which an opportunity is afforded by the Garston site, of which the Company may be expected to avail themselves, of erecting works upon the most modern lines to take the place, in part at least, of some of the oldest manufacturing plant. A considerable saving in the cost of manufacture might in this way be effected, especially having regard to the scale upon which it could be conducted.

It may also be pointed out, that the economy of a gas-works can hardly be considered complete without provisions for removing the carbonic acid from the gas. This is effected, to a certain extent, by its combination with ammonia in the washers and scrubbers, at the outlet of which, however, there is usually sufficient to depreciate the illuminating power of the gas by nearly one candle. The removal of this quantity by means of lime—not necessarily in substitution for oxide of iron, but as an addition to it—is a much less costly means of raising the illuminating power than any enriching process, or the use of expensive cannel. Oxide of iron only removes sulphuretted hydrogen from the gas; and this is the sole material used for purification at four of the works, representing a maximum daily production of upwards of eight million cubic feet.

With regard to the second of the two questions referred to me, the practice of the Company appears to be to use mostly first-class gas coal from the Wigan and Yorkshire districts, and raise the gas produced from this to the standard quality by means of good cannel or Australian shale. In this way, the consumption of the most expensive material must be much less than if common gas coal were used; and this is certainly an object to be aimed at, having regard to the disproportionately higher price of such material. There are doubtless many low-priced cannels to be had, and occasionally in considerable quantities. But according to my experience, very few of them could be depended upon for maintaining such a high standard of illuminating power as that of Liverpool; nor can they be carbonized to advantage owing to the very inferior quality of the coke which they produce. It appears to me, therefore, that the Company are driven by the necessities of their position, in regard to the illuminating power which they have to maintain, to the use of the most expensive material, and for which they may have to go farther and farther afield. At the same time, much must always depend upon the selection which may be made—more particularly, perhaps, when, as in this case, the choice is necessarily a restricted one; but I saw nothing that could lead to the conclusion that the selection of material had been otherwise than well and carefully made.

As illustrating the superior economy of the manufacture of common gas as compared with cannel gas, it may be mentioned that one of the coals now being used in Liverpool (a very good Yorkshire silkstone) was offered in Birmingham last year at 11s. 11d. per ton delivered; the actual price paid for our supply averaging a fraction over 9s. per ton. In comparison with this, and allowing for its higher illuminating value and the better quality of its coke, the coal referred to would have been worth to us about 10s. 7d. per ton. The difference of 1s. 4d. per ton represented in part excess railway rate, owing to the distance of the colliery from the works, and in part a high pit price in recognition of its being a first-class gas coal.

Again, the Australian shale contains, according to our analysis, from three to four times as much illuminating matter as our average coal costing 9s. per ton delivered. Setting the coke from the coal against the saving in labour, &c., in carbonizing the shale, the intrinsic value of the latter would appear to be from 30s. to 36s. per ton, although a very much higher price than this is paid for it as an enriching material.

At the present price of oil, the carburetted water gas made at Garston must be costing less than the coal gas made at the other works; and its economy would probably be more apparent if the manufacture of it were upon a larger scale, so as to bring down the dead charges of the works. Contrary also to what is the case with coal gas, the cost per candle should not increase with the illuminating power—the oil used being proportionate to the latter, while the cost for labour, &c., whether for poor or rich gas, is practically the same. As an enricher, consequently, this gas should compare favourably with cannel, so long as oil can be obtained at a moderate cost. Hitherto this use has not been made of the gas produced at Garston; these works being apparently intended simply to take up the increase in the consumption. If, however, it were to be so used in conjunction with the coal-gas plant supplied with gas coal, not necessarily of the best quality, from the nearest available coal-field, there should not be any difficulty in making gas of any desired quality much cheaper than by the present system.

(Signed) CHAS. HUNT.

THE FINANCIAL POSITION OF THE BOLTON GAS, ELECTRIC LIGHTING, AND WATER UNDERTAKINGS.

The annual statement published by the Borough Treasurer of Bolton (Mr. G. Swainson) furnishes some interesting details as to the gas and water undertakings. He says that, comparing the gas-works accounts of last year with those for the present year—*i.e.*, the twelve months ending March 25—it is noticeable that the manufacture of gas cost £65,516, as against £61,313; and that the sale of gas realized £105,152, compared with £104,055 in the year 1894-5. The latter figures are very interesting from the fact that the price of gas for 1896 was reduced from 2s. 8d. to 2s. 6d. per 1000 cubic feet, or lower than it has been since 1888-9. The effect of the abolition of the meter-rents was shown in a reduction of the amount received from this source from £1428 in 1894-5 to £870 for 1895-6. The number of meters in use outside the borough in respect to which the charge is still maintained, is only one-fourth of those within the limits. The residual products show a reduction from £27,415 to £24,715, mainly owing to the fall in the price obtained for sulphate of ammonia. While the fittings trade increased from £987 to £1405, a loss of £367 was recorded on the gas cooking and heating apparatus department; but the Corporation are recouped for this by the augmented consumption of gas through this medium. The interest charges are rather heavier (£21,407, against £21,011), owing to the increased outlay of capital on works; while as the result of the decreases mentioned, the Gas Committee were only able to transfer in aid of rates £21,432, compared with £23,478 last year, and to set apart for the renewal of works £9279, against £14,773 in the year 1894-5. Mr. Swainson points out that the ratepayers cannot expect to have a reduction in the price of gas as well as an increased amount handed over from the Gas Department in aid of the rates. Last year, the Corporation spent £6350 on the renewal of works and plant; and wrote off capital a sum of £5000. The renewal of works comes to the very large sum of £16,825. For the first time, the general balance-sheet shows the effect of the conversion of the gas annuities. The value of those unconverted at the end of the financial year was £5426; and at 30 years' purchase represented £162,777, as against £433,807—the difference being the annuities converted into Corporation stock. Therefore the redeemable stock at 3½ per cent. is increased by £271,030.

Scanning the capital account in connection with the electric lighting undertaking, the Borough Treasurer says it shows that the Corporation have laid out more in the way of capital than the ratepayers are taking out in revenue. The plant laid down could supply ten times the quantity of current at present used; and if the public do not more extensively avail themselves of the new illuminant, its supply will apparently continue a loss for some years, unless the surplus day service is utilized by the introduction of electrically driven tramcars on the town and suburban tramways.

In regard to the water-works, the rental shows a decrease on the year from £53,734 to £53,196; but this is accounted for by the fact that the Leigh and Hindley Local Board district have ceased to use water obtained from Bolton. This represents a loss of income of £3500 a year; and the Borough Treasurer says the Committee have to be thankful the accounts are not worse. The amount taken last year from the profit in aid of local rates was the same as in the previous year—viz., £10,000.

ELECTRIC LIGHTING NOTES.

After a three years' struggle in the Lambeth Vestry between the Moderates and Progressives as to whether the electric light should be provided for the use of the inhabitants of the parish by the Vestry or a private electric lighting company, it has at last been decided by the Moderate majority as the most economical course to transfer the Provisional Order to Mr. C. W. Sax, of Messrs. Julius Sax and Co. In consideration of this concession, Mr. Sax will place 25 arc lights free of charge at the disposal of the Vestry for the general benefit of the parish.

Mr. Rienzi Walton, M.Inst.C.E., held an inquiry in the Town Hall, Hastings, on the 19th ult., in regard to an application made by the Corporation to the Local Government Board for power to borrow the sum of £17,650, of which £7560 is required for electric lighting purposes. The Town Clerk (Mr. B. F. Meadows) stated that in 1890 a Provisional Order was obtained for public lighting purposes; but it was not thought desirable to take up general lighting. They had not availed themselves of the Order, and had been content to contract for the lighting with the Hastings and St. Leonards Electric Light Company, who obtained powers in the same session. The present position was that the contract with that Company would expire in July, 1897. The cost was £25 per lamp for 52 lamps in the streets. The Company also supplied light for the various public buildings. The Corporation had been in communication with the Company, to ascertain whether or not they would be prepared to renew the contract. But they intimated that they did not find it answer their purpose to supply light at that price; and if it was renewed, it would have to be at a much higher figure. A Sub-Lighting Committee inquired into the matter, and came to the conclusion that they could work successfully a system on the Front at a considerable saving to the ratepayers; and they therefore decided to ask for a loan, which was estimated to cover the cost of the alterations to the building they proposed to convert into a generating station, and the plant they would have to take over. They did not propose to acquire the Electric Light Company's premises; they only took the special plant used for public lighting purposes. It was thought reasonable that at the end of the three years expiring in July next the Corporation should obtain the plant at a proper valuation. They based their application on the estimate of the Borough Engineer (Mr. P. H. Palmer). Mr. Palmer explained that they only proposed to light the existing 52 lamps on the Front, extending over a space of about 2½ miles. The building was erected 47 years ago. They should put in two Babcock boilers, each of 150-horse power, three dynamos, and the necessary instruments. The lamps would be each of 2000-candle power; and provision would be made for an extension of the street-lamps. There was no opposition to the application. The estimate of the Borough Engineer was given in the "JOURNAL" for June 2 last. It may be remembered that he put the cost of an installation on the alternate transformer system (that adopted by the Electric Light Company), complete in every respect for maintaining 70 arc lamps and duplicates, including the purchase of the Company's plant, at £7560; and the estimated annual cost of running 50 arc lamps, including interest at 3 per cent. and sinking fund, ample provision for maintenance, deterioration of machinery and lamps, &c., at £1639—equalling £32 15s. 7d. per lamp per annum.

The Gas Committee of the Brighouse Corporation have recommended the purchase for £1535 of the electric-lighting plant which is being run by a private gentleman in the town. The present owner will continue to work the plant, at his own risk, until a Licence has been obtained by the Corporation from the Board of Trade.

The Price of Gas at Sowerby Bridge.—The Gas Committee of the Sowerby Bridge District Council have decided to recommend a reduction in the price of gas of 3d. per 1000 cubic feet to consumers supplied from Sowerby Bridge, with the exception of a few mills in the Ripponden Valley. These mills, at the time the gas-works were acquired by the then Local Board, were conceded certain privileges, in consideration of services they rendered in assisting the Local Board to obtain the power to purchase. It is thought, however, that these services have now been amply repaid. The price of gas for the future, should the Council adopt the Committee's proposal, will be 2s. 3d. inside the district, and 3s. 1d. outside. With regard to Luddenden Foot, it is proposed that those who have been paying 3s. 9d. shall henceforth be charged 3s. 6d.; but no reduction is to be made to the millowners with whom a special agreement was entered into when the Luddenden Foot works were acquired.

THE WATER SUPPLY OF EAST LONDON.

The Present Position—Need for Storage Cisterns—Suggested Supply by Meter.

The position of affairs in connection with the water supply in the district of the East London Water Company has not very materially changed since the subject was last referred to in this part of the "JOURNAL." Early in the past week, the Secretary of the Company (Mr. I. A. Crookenden) informed a Press representative that the rains which have lately fallen had not helped them at all so far as the River Lea was concerned. Indirectly, of course, they were of value, because they watered people's lawns and made the roads comfortable, and hence there was a saving of water in that way. But the volume of water in the river had not increased perceptibly. What was wanted was, he said, a good steady downpour for six days and six nights. Speaking on the question generally, Mr. Crookenden stated that it was solely one of storage. The East London Company were the pioneers of the constant service system; but with proper storage facilities, there ought not to be the least inconvenience from the intermittent supply. Throughout the present drought, they had never given less than 154 gallons per day to every house in their district. Unfortunately, however, the consumers took not the slightest interest in the conservation or careful use of the water, and made no provision against drought, frost, or the breaking of the mains. He laid stress upon the fact that the drought since 1893 had been abnormal; and said he supposed there had not been so small a rainfall for eighty years as they had lately experienced. He explained that the Company had three new reservoirs. One was already in use, another was just upon being finished, and the third would be available about April or May next. The total capacity of these would be 650 million gallons. With regard to the proposed Water Trust, Mr. Crookenden said that if it had been in existence now it would not have had the slightest effect on the present state of affairs. Summing up the situation, he said that, in the first place, Parliament did wrong to refuse to allow the Company to conduct their business in their own way; in the second place, the landlords were to blame for not supplying a proper storage system to their houses; and, in the third place, the local authorities, who were the sanitary authorities under the Public Health Act of 1891, failed in their duty in not seeing that each house had a proper water supply, and without tanks for storage it was impossible to have such a supply.

The closing words of the foregoing paragraph set forth the real cause of all the trouble. It is the absence of means of storing the water, coupled with wasteful habits, that has brought so much inconvenience upon the consumers and so much abuse upon the Company. In the midst of much vituperation issued from the Press, "The Times" has been conspicuous for the fair and temperate manner in which it has dealt with the question. The articles by its special correspondent are, on the whole, founded upon information obtained after personal investigation. In the one which appeared on Monday last week, the writer discussed the two points above referred to—storage and waste; basing his opening remarks upon some suggestions made by the writer of a letter which appeared in our contemporary on the 17th ult. Referring to the communication addressed to Mr. Balfour on the subject of the appointment of a Water Authority for the Metropolis, the writer pointed out that while the public might thus obtain direct control over the water supply—though probably at an increase in the water-rate—the intervention of the authority would be of no practical avail unless it could make sure of securing (1) proper storage cisterns in every house, (2) the proper use of the supply by the consumers, (3) the prevention of waste through taps being left open, and (4) the active co-operation of the "Clerk of the Weather." These conditions, but especially the first and third, are all-important. To use the words of "The Times" correspondent, they "hit the water question in the centre." The necessity for having a properly constructed storage cistern in every house was emphasized by Dr. Pringle in the letter which appeared in our columns on the 18th ult.; and it is further enforced by one from an "Inspector" which is given elsewhere. The writer of the articles in "The Times" thinks it is obvious that, whatever may be done in the way of providing increased storage or obtaining fresh sources of supply, the constant service must be accompanied by an effectual system of preventing waste which is the result mainly of defective fittings, the use of garden hose, and sheer carelessness. But reform in these matters is, he says, less urgent than the provision of cisterns. Their general abolition at the East-end of London is now regarded as a great mistake. On this point he remarks as follows: "Of course, a constant supply is the proper thing; and sanitary science has been perfectly right in insisting upon it. But from that to the abolition of cisterns was a headlong step, not according to knowledge. A constant service which will never be liable to interruption is an impossible ideal. It implies first an inexhaustible supply; and for a town so large as London, there is not, and cannot be, such a thing. It implies, secondly, everlasting pipes and absolute freedom from accidents. It never occurred to the sanitarians, who are inveterate idealists, that accidents and wear and tear must be taken into account—that a large main may burst, for instance, from the subsidence of a roadway; and that, in the ordinary course of nature, repairs must be executed from time to time. These things alone may necessitate cutting off the water from a large district, possibly for 24 hours or more. Moreover, no man can foretell the seasons, and what they may bring forth. In short, it is absolutely indispensable that all houses should be prepared to fall back on an intermittent supply, unless the occupiers are to be put to great inconvenience. There is nothing objectionable in it. The notion that all cisterns are necessarily evil is a false and unscientific deduction from the fact that some are. The proper remedy for bad cisterns is good ones, not none at all; and good ones, that are open to no sanitary objection, can easily be obtained. The following passage from the report of the Local Government Board's Inspectors on last year's inqury may be taken to embody the opinion of the highest sanitary authority in the country:—

No doubt ill-designed and badly-placed house cisterns are open to objection from a health point of view; and nothing could be farther from our intention than to advocate any return to the old defective cisterns, with their movable wooden covers. But we do advocate provision of properly designed cisterns. Under the best arrangements, there must be times when short periods of interruption of a constant service will occur; and at such times the want of water for domestic purposes, or flushing water-closets, sealing water-traps, &c., is calculated to lead to conditions injurious to health, which should not be allowed to exist, and which a proper use of really efficient cisterns would guard against.

Had this advice been followed, there would have been no inconvenience this year. Houses properly provided in the East London district have suffered none; and when people call an intermittent service a 'famine,' they forget, or do not know, there are upwards of 140,000 houses in London which never get anything else, and that in many of them—West-end houses, too—the water is at no time turned on for more than one hour a day. Yet they suffer no inconvenience, because they have cisterns. If the pretended champions of the poor consumer cared twopence-halfpenny about him, except as a lever for furthering their own ends, they would at least have urged that cisterns should be provided by those who took them away, and they would urge it now."

The foregoing considerations seem to the writer to constitute a very strong argument in favour of a public Water Authority. Waste must be prevented and proper cisterns provided; and such an authority would, he thinks, be in a far better position to effect these reforms than the Water Companies can ever be. He points out that those who most loudly call for the change never have any reasons to give for it, beyond that blessed word "Municipalization" and general abuse of the Companies—abuse which is always ignorant and often mendacious. But the consumer should, he says, clearly understand what the reform will mean to him It will probably mean higher rates, for public bodies are expensive luxuries in London; it will certainly mean more interference with the Englishman's castle, and far more peremptory treatment. The consumer must expect to be ordered to put in new fittings at a day's notice, to be forbidden to water his garden or to swill pavements and wash windows, and, if he disobeys, to have his water cut off. In return, he will have the satisfaction of addressing complaints to a clerk instead of a secretary, and of knowing that, if he goes to law about it, he will be fought with his own and the other ratepayers' money.

In the course of a leading article in "The Times" on the same day, the writer, when dealing with the question of waste, remarked that the best remedy for this would be "the supply of water by meter, with rates charged according to the quantity used." A day or two after, a correspondent—"L. H."—pointed out that this might be effectual where the consumer paid directly for the water supplied. In the case of small houses at the East-end, however, where the effects of the late drought have been most severely felt, the landlord almost invariably pays the water-rate. Consequently, payment by meter would be no deterrent to the consumer (the tenant); and he might go on wasting the water, as he has done in the past, with absolute impunity. Grievous injustice might thus be done to the landlord, especially if the tenant bore him a grudge—a by no means uncommon case. Then with regard to the provision of storage cisterns, the writer says: "The question arises as to who is to bear the outlay. The landlord, who, in constructing the houses, has carried out the requisitions of the local sanitary authority by making the water supply entirely dependent on the main, or the ratepayers, whose officer has committed the blunder? The expense to the unfortunate landlord would be serious; but in these days of county councils scant justice is meted out to both landlords and water companies. Another point is, if cisterns are to be supplied, must not the water to be used for drinking be kept entirely apart from that used for sanitary and domestic purposes?"

Among the other correspondents who have dealt with the present difficulty in the columns of the leading journal is Mr. George Livesey, who last Wednesday sent the following letter to the Editor:—

Sir,—Unquestionably the best, if not the only, effective remedy against waste of water is the suggestion made in your leading article in "The Times" of Monday—viz., the supply of water by meter; but to the adoption of the proposal your correspondent "L. H.," in "The Times" of to-day, raises the serious objection that, as the water-rate is almost invariably paid by the landlords of small house property, the supply by meter would not act as a deterrent to the tenant. It occurs to me that the penny-in-the-slot system could as easily and as successfully be applied to water as it has been to gas. The tenant would then pay directly for his water, as he required and used it, by pennyworths at a time; the landlord, of course, reducing the rent by the amount he has been paying for water-rate. If this were done, there would be no necessity for a minimum charge, which is objectionable. In the early days of gas-meters, a minimum charge was made in certain cases; but this has been abolished, to the satisfaction both of the gas supplier and the gas consumer.

I have often wondered why the London Water Companies have not followed the example of the Gas Companies by amalgamating. I think one huge concern would be a mistake—I am sure it would in the case of gas, for it would destroy the competition of comparison, which is an undoubted advantage to the consumer. But to have (say) two Companies on the north and one on the south of the river would surely be better than the present eight Companies.

One of the most serious defects in the system of water supply by companies—and the same applies to corporations—is that they have not the slightest inducement to supply this necessity of life as cheaply as possible. During the last forty or fifty years, gas in London has been reduced more than 50 per cent.—from 6s. per 1000 cubic feet in 1848 to its present price of less than 3s.; while little or nothing has been done with water. This is probably due in the first place to the system, and to the fact that for water there is no substitute, while gas has always had competitors.

If water were supplied by meter like gas at a certain price per 1000 gallons, with a proviso that increase of dividends should follow reductions of price, on the principle of the sliding-scale of the Gas Companies, there is surely no reason why the effect should not be the same. The Companies would have a direct interest in doing their best for the public, with the result that there would be an abundant supply and a decreasing price.

Last Friday, the special correspondent of "The Times" announced that the East London Water Company had a sufficient stock in their reservoirs to carry them over September, although that is usually the driest month in the year. Moreover, the New River Company are now in a position to give rather more assistance; and arrangements have been made accordingly. All danger, therefore, of a further reduction in the supply to the consumers may be considered over.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The accounts of the Aberdeen Corporation gas department for the year ending July 31 have been issued. A very successful year has been experienced. There was an output of gas amounting to 460,858,000 cubic feet—an increase of 30,289,000 cubic feet upon the quantity in the preceding year. As 45,854 tons of coal were carbonized to produce this quantity of gas, the yield per ton was more than 10,000 cubic feet. There was a leakage of 8·18 per cent., as compared with 8·77 per cent. Coal cost 16s. 3¾d. per ton, which was 2¼d. per ton more than in the preceding year. There was a total revenue of £78,818, £68,728 of which was derived from the sale of gas, and £9633 from residuals. Though the price of gas had been reduced from 3s. 5d. to 3s. 4d. per 1000 cubic feet, the revenue from the sale of gas was £3288 more than in the preceding year. The ordinary expenditure is stated to have amounted to £68,257, made up of £51,252 for coal and manufacture of gas; £1699 for distribution; £5714 for rents and taxes; £1946 for management; £2710 for discount and bad debts; and an allowance of £4746 for depreciation. There was a surplus of £10,560; but the following necessary payments fall to be made: Annuities, £4988; interest on mortgages, &c., £3042; sinking fund, £3030; redemption of gas annuities, £1899; reserve and insurance fund, £300—amounting in all to £13,259. A year ago, however, a balance of £6349 was carried forward; and, deducting from this sum the amount of the deficit for the past year, there remains a balance of £3650. With reference to the capital account, it is stated that in 1871 gas annuities were payable on the sum of £114,933; but since then of this sum there has been redeemed £39,050, by means of the contingent fund. This leaves only a sum of £75,883 upon which annuities are now payable. Loans on mortgage, which amounted to £102,293, have been, by the operation of the sinking fund, reduced to £67,008. That is to say, in 25 years the Corporation have reduced their total liabilities from £217,226 to £142,891. The sum thus paid has amounted to £74,335—a little more than one-third of the total liability. There are temporary loans at present to the amount of £4715; but adding these to the existing liabilities, it is found that the total assets, amounting to £153,956, are £6349 more than the total liabilities. There is a sum of £18,391 at the credit of the reserve and insurance fund.

In such a favourable state of matters, it might be expected that the question would arise whether it is advisable to go much further in the direction of reducing the liabilities, or whether the rate of reduction might not be lessened, and whatever surpluses may arise be applied in the reduction of the price of gas. I have not gone into the calculation, which would be a somewhat problematic one at best; but, at the present rate of reduction, it is probable that in a little more than 30 years, the whole of the capital liabilities of the undertaking would be extinguished. Something of such a question did, in fact, arise at a meeting of the Gas Committee on Wednesday, when the accounts for the past year and the estimates for the current year were under consideration. The estimates provided, on the basis of the price of gas remaining at 3s. 4d. per 1000 cubic feet as at present, for an income of £70,000 from the sale of gas, and of £9600 from the sale of residuals; and for an expenditure of £82,627. Adding, however, to the total revenue of £79,600, the £3650 brought forward, there would be an estimated surplus of £624. Some of the members of the Committee thought that they would be justified in reducing the price of gas by 1d. per 1000 cubic feet. The situation would have been a narrow one had this been done; and I agree with the Committee in their resolution to, in the meantime, keep the price of gas at 3s. 4d. To reduce the price of gas would be to work for an anticipated or almost a certain deficit; and to do this for two years in succession would not, in ordinary circumstances, be advisable. The accounts have yet to be submitted to the Town Council.

The cost of public lighting in Aberdeen during the past year was £6266, or £308 more than the estimate; the excess being due principally to the erection of additional electric lamps. For the current year the estimate is £6522.

I mentioned a week or two ago that the Coatridge Town Council had resolved to offer the Scottish House-to-House Electricity Company, of London, £15 per electric arc lamp for the lighting season of the public lamps. As was to be expected, such an offer has not been accepted. The refusal of the Company was intimated at a special meeting of the Town Council on Tuesday; and the Council would seem to have thereupon surrendered to the Company, as they remitted to the Lighting Committee with powers to come to the best arrangement possible with the Company, with a view to the lamps being lighted.

An attempt is about to be made by a London electric lighting company to establish an installation in Inverness. The Corporation of Inverness two or three years ago considered whether they should start an installation of their own, but resolved not to do so, as there was no prospect of their being successful. The Corporation lately resolved to oppose the movement by the London company. In their opinion, they are quite capable of supplying any artificial light which may be required; and they consider it would be foolish for them to support a foreign company when so much of the ratepayers' money is at stake. "*Nemo me impune lacessit*" seems to be their motto.

Arrangements have just been made for the formation of a special lighting district in Renfrew parish. These may be given as a guide to others who may be contemplating taking advantage of the provisions of the Local Government Act in that respect. The capital expenditure for the purchase and erection of lamps, &c., is estimated at £163 2s.; and the ordinary outlay till the 15th of May, 1897, at £145—involving an assessment on the increased valuation of the current year—viz., £10,295—of 3½d. in the pound. The Upper District Committee of the

GAS AND WATER COMPANIES' STOCK AND SHARE LIST (see ante, p. 406).

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	15 Apl.	10½	Alliance & Dublin 10 p. c.	25½–26½	..	3 19 3
100,000	10	,,	7½	Do. 7 p. c.	18–19	..	3 18 11
300,000	100	1 July	5	Australian (Sydney) 5% Deb.	108–110	..	4 10 11
200,000	10	12 June	5	Belgrano (B. Ayres), Limited	10–10½	..	4 15 3
100,000	Stck.	26 June	5	Do. 5 p. c. Deb. Stk	100–103	..	4 17 1
200,000	5	29 May	6½	Bombay, Limited	7⅞–8¼	..	3 18 9
40,000	5	,,	6¼	Do. New, £4 paid	5¾–6	..	4 6 8
380,000	Stck.	13 Aug.	12	Brentford Consolidated	285–290	..	4 2 9
210,000	,,	,,	9	Do. New	215–220	..	4 1 9
50,000	,,	,,	5	Do. 5 p. c. Pref.	140–145	..	3 9 0
159,375	,,	12 June	4	Do. 4 p. c. Deb. Stock.	130–134	..	2 19 9
220,000	Stck.	27 Mar.	11½†	Brighton & Hove Original	247–252	..	4 11 3
208,820	,,	,,	8½†	Do. A Ord. Stk.	190–195	..	4 7 2
933,500	Stck.	28 Aug.	5	Bristol, 5 p.c. max.	127–132*	+1½	3 15 9
420,000	20	27 Mar.	11½	British	57½–58½	..	3 16 11
50,000	10	28 Aug.	11½	Bromley, Ordinary 10 p. c.	22–23*	..	5 0 0
71,000	10	,,	8½	Do. 7 p. c.	19–20*	+½	4 5 0
500,000	10	29 Apl.	5	Buenos Ayres (New) Limited	10½–11	+¼	4 10 11
200,000	100	1 July	6	Do. 6 p. c. Deb.	103–106	..	5 13 2
150,000	20	15 July	8½	Cagliari, Limited	29–31	..	5 6 5
100,000	10	29 May	8	Cape Town & District, Ltd.	16–17	..	4 14 1
50,000	50	2 May	6	Do. 6 p. c. 1st Mort.	58–60	..	5 0 0
550,000	Stck.	15 Apl.	13½	Commercial Old Stock	345–350	..	3 17 2
165,000	,,	,,	10½	Do. New do.	260–265	..	3 19 3
165,000	,,	12 June	4½	Do. 4½ p. c. Deb. do.	152–157	..	2 17 3
800,000	Stck	12 June	13	Continental Union, Limited.	285–290	..	4 9 8
200,000	,,	,,	10	Do. 7 p. c. Pref.	220–225	..	4 8 11
51,600	Stck.	28 Aug.	14	Croydon Com'cial A 10 p. c.	315–320*	..	4 7 6
163,400	,,	,,	11	Do. B 7 p. c.	250–255*	..	4 6 3
535,000	Stck.	28 Aug.	5½	Crystal Palace Ord. 5 p.c. Stk	140–143*	+2	3 13 5
60,000	,,	,,	5	Do. 5 p. c. Pref.	140–145*	..	3 9 0
486,090	10	15 July	11	European, Limited	26½–27½	..	4 0 0
354,060	10	,,	11	Do. £7 10s. paid	18–19	..	4 6 11
5,746,590	Stck.	13 Aug.	12¾	Gaslight & Coke, A, Ordinary	314–319	+1	3 19 11
100,000	,,	,,	4	Do. B, 4 p. c. max.	110–115	..	3 9 7
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	305–315	+5	3 3 6
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	147–152	..	3 5 9
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	212–217	..	3 9 1
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	207–212	+2	3 6 0
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	305–315	+5	3 3 6
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	173–178	..	3 7 5
1,061,150	,,	12 June	4	Do. 4 p. c. Deb. Stk.	138–143	..	2 15 11
294,850	,,	,,	4½	Do. 4½ p. c. do.	153–158	..	2 16 11
908,000	,,	,,	6	Do. 6 p. c. do.	207–212	..	2 16 7
70,000	10	14 May	6	Hongkong & China, Limited	12–13	..	4 12 4
3,826,000	Stck.	14 May	12	Imperial Continental	252–257	..	4 13 4
376,400	100	1 Aug.	4	Do. 4 p. c. Debs. Red.	100–103	..	3 17 8
473,600	Stck.	13 Aug.	3½	Do. 3½ p. c. Deb. Stk ,,	108–110	..	3 3 8
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	6–6½	..	4 12 4
560,000	100	1 Apl.	5	Met. of Melbourne, 5 p. c. Deb.	115–118	..	4 4 10
250,000	100	,,	4½	Do. 4½ p. c. Debs.	110–112	..	4 0 4
541,920	20	12 June	5	Monte Video, Limited	16½–17½	..	5 14 3
150,000	5	29 May	8	Oriental, Limited	8¼–8¾	..	4 11 5
135,000	5	,,	8	Do. New, £4 10s. paid	7¾–7¾	..	4 12 10
15,000	5	,,	8	Do. do. 1879, £1 paid	1¾–2	..	4 0 0
60,000	5	12 Mar.	7	Ottoman, Limited	5–5½	..	6 7 3
420,000	100	1 May	6	People's Gas } 1st Mtg. Bds.	105–110	..	5 9 1
500,000	100	1 June	6	of Chicago } 2nd Do.	102–107	..	5 12 1
250,000	10	27 Mar.	8	San Paulo, Limited	13½–14½	..	5 10 4
5,475,000	Stck.	13 Aug.	5⅛	South Metrop., 4 p.c. Ord.	150–153	+3	3 7 11
820,000	,,	15 July	5	Do. 5 p. c. Deb. Stk.	173–176	..	2 16 10
60,000	Stck.	12 Mar.	11½	Tottenham & Edmonton, A	235–245	..	4 14 0
60,000	,,	,,	8½	Do. B	185–195	..	4 7 2
170,380	10	29 May	10	Tuscan, Limited.	13½–14½	..	6 18 0
149,900	10	1 July	5	Do. 5 p. c. Debs. Red.	100–102	+2	4 18 0

WATER COMPANIES.

746,123	Stck.	26 June	10½	Chelsea, Ordinary	345–350	..	2 18 7
150,000	,,	,,	5	Do. 5 p. c. Pref.	177–182	+2	2 14 11
160,000	,,	,,	4½	Do. 4½ p. c. Pref. Stk., 1875	160–164	..	2 14 10
175,785	,,	27 Mar.	4½	Do. 4½ p. c. Deb. Stock	165–170	..	2 12 11
1,719,514	Stck.	15 Apl.	7	East London, Ordinary	237–242	..	2 17 11
654,740	,,	26 June	4½	Do. 4½ p. c. Deb. Stk.	165–170	..	2 12 11
100,000	,,	,,	3	Do. 3 p. c. Deb. Stk.	105–107	..	2 16 1
700,000	50	12 June	7½	Grand Junction, 10 p.c. max.	123–127	..	2 19 0
280,000	Stck.	27 Mar.	4	Do. 4 p. c. Deb. Stk.	152–157	..	2 10 11
708,000	Stck.	13 Aug.	12	Kent	347–352	..	3 8 3
160,000	,,	,,	7	Do. New, 7 p. c. max.	220–225	..	3 2 3
1,043,800	100	26 June	7½	Lambeth, 10 p. c. max.	267–272	–1	2 15 2
406,200	100	,,	7½	Do. 7½ p. c. max.	227–230	..	3 5 2
350,000	Stck.	27 Mar.	4	Do. 4 p. c. Deb. Stk.	152–157	..	2 10 11
500,000	100	13 Aug.	12⅝	New River, New Shares	433–438	..	2 18 11
1,000,000	Stck.	30 July	4	Do. 4 p. c. Deb. Stk.	157–160	..	2 10 0
902,300	Stck.	12 June	4	S'thwk & V'xhall, Ordinary	155–160	..	2 10 0
126,500	100	,,	4	Do. Do. 7½ p. c. Max.	150–155	..	2 11 7
489,200	Stck.	,,	5	Do. Do. 5 p. c. Pref.	175–180	..	2 15 6
1,019,585	,,	15 Apl.	4	Do. 4 p. c. A Deb. Stk.	153–156	..	2 11 3
1,155,066	Stck.	12 June	10	West Middlesex	328–333	..	3 0 0
200,000	,,	,,	4½	Do. 4½ p. c. Deb. Stk.	165–170	..	2 12 11

*Ex div.

† Next dividend will be at this rate.

County Council, although the assessment will apparently exceed the limit of 3d. in the pound, in view of the rapidly increasing valuation of the district, approved of the estimate, and authorized application to be made for the consent of the Standing Joint Committee to the work and capital expenditure involved, and for a loan of the amount—viz., £163 2s.—repayable, principal and interest, in the course of 30 years.

Early yesterday morning a serious case of gas poisoning occurred in the Calton district of Glasgow, which is one of the oldest parts of the city. A woman who had wakened up found her house filled with an odour of gas, and endeavoured by opening all the windows to clear it out. She was unsuccessful; and it then occurred to her that she ought to rouse the inmates of the house immediately below hers. She knocked repeatedly at their door; but got no answer. Then she informed the police, who also failed to get any response from within. A window was therefore broken, and the house entered. The smell of gas was very strong; and the four inmates—a Mrs. Connor, her daughter, and two sons—were found to be all lying in their beds unconscious. They were removed to the Royal Infirmary, where, up till this morning, they had not recovered consciousness. The leakage, it was discovered, came from a fracture in a 4-inch main, below the pavement, just outside the house. A curious circumstance in connection with the occurrence was that in one of the rooms in the house, notwithstanding the large quantity of gas in the atmosphere, the gas was lighted but turned down. [Later reports state that the two sons, James and William Connor, died at midnight on Saturday, without having recovered consciousness. The condition of the mother and daughter is still critical.—Ed. J. G. L.]

CURRENT SALES OF GAS PRODUCTS.

Liverpool, *Aug.* 29.

Sulphate of Ammonia.—There have been no new developments during the week. A fair amount of business has passed; and it is satisfactory to note that to some extent the buying has been for consumers' account, though the bulk of the purchasing is by dealers to fill engagements for the current month. The Scotch makers, being the more willing to meet the market, have secured the greater portion of the orders; and £7 12s. 6d. was realized during the early part of the week. At the close, the tendency is rather easier—the covering operations being apparently completed; and £7 11s. 3d. f.o.b. Leith would now be accepted. At the English ports, the volume of business has been moderate; and quotations are £7 12s. 6d. f.o.b. Hull, and £7 15s. Liverpool. As regards forward delivery, makers' views have undergone little or no change; but speculators continue to offer freely to the Continent, for delivery into the spring months, at very narrow premiums over spot values. Such business appears most hazardous; for, compared with other fertilizers, the anomalously low price of sulphate should turn the scale in its favour, and consumers' attention must sooner or later be attracted to this commodity, being the cheapest of its class.

Nitrate of Soda is unchanged at 7s. 10½d. to 8s. per cwt.

London, *Aug.* 29.

Tar Products.—A little more business in now reported in pitch. As the season for shipment advances, buyers are compelled to make arrangements for their supply. A sharp advance has taken place in the value of benzol, particularly for prompt delivery. Solvent naphtha is also dearer. A determined effort seems to exist to depress carbolic acid; and some makers have apparently fallen into the trap, as sales have been made as low as 1s. 9d. for 60's. Anthracene is more inquired for; and it is more than likely that the next month will see an important move in this article. Creosote and salts, as well as heavy tar oils, are scarcer; and this is reflected in their improved value. Speculative prices have been paid for tar; but the higher prices that have been paid are only for tars containing large quantities of benzol and light products. Many tars, however, contain little or none of these; and they are therefore not affected by the sharp rise that has taken place in benzol and its homologues.

Values obtaining during the week are: Tar, 19s. to 27s. 6d. Pitch, 31s. Benzols, 90's, prompt, 4s. 6d.; forward, 3s. 10½d.; 50's, prompt, 3s.; forward, 2s. 9d. Toluol, 2s. 4½d. Solvent naphtha, 1s. 6d. Crude naphtha, 30 per cent. prompt, 1s. 3d.; forward, 1s. 1d. Creosote, 2d.; liquid, 2⅜d. Heavy oils, 4½s. Naphthalene, pressed, 6½s.; salts, 35s. Cresylic acid, 1s. Carbolic acid, 60's, 1s. 9d. to 1s. 10d. Anthracene, "A," 10½d.; "B," 8½d.

Sulphate of Ammonia shows more life; and considerable business is reported, though at miserable prices. At Scotch and north-eastern ports, £7 10s. to £7 12s. 6d. has been taken, while £7 15s. is asked for south-eastern and western ports, all less 3½ per cent. There is now more pressure to buy for forward delivery; but makers would be wise not to accept the small advance offered for this position. In sympathy with the lower price of sulphate of ammonia, gas liquor is now quoted at 5s. 6d. to 6s. 6d., according to conditions of sale and relative positions of buyers' and sellers' works.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—The position shows no appreciable improvement; business generally moving on but slowly, with very few collieries working above three and a half to four days per week. At the pit, best Wigan Arley does not average more than 9s. 6d. to 10s. per ton; Pemberton four-feet and seconds Arley, 8s. to 8s. 6d. per ton; and steam and forge coals, 5s. 6d. to 6s. per ton. A continued absence of activity is reported in the shipping trade; only a small weight of business coming forward generally, with no better prices ruling. Common round coal for steam purposes is not fetching more than 7s. to 7s. 3d. per ton, delivered at Mersey ports; while good seconds qualities of round coal could be bought at 8s. 6d. to 9s.

Northern Coal Trade.—There has been a slight declension in the demand for steam coals; but nearly all the collieries have still full work, though in one or two instances a slightly lower price has had

NEW "PENNY-IN-THE-SLOT" COOKERS.

Arranged specially for Prepayment Meters.

We have given particular attention to the strength and simplicity of these Cookers, which are constructed upon the principle of our celebrated "Eureka" Cooker, and are practically indestructible. They are very easily cleaned, and are all constructed in as many parts as possible, so that, in case of breakage, the parts may be readily and cheaply replaced.

No. 403 and 404.

No.	External Dimensions.			Oven.			Hot Plate.	No. of Boiling-Burners	Price.	White Enamelled Crown extra.
	High.	Wide.	Deep.	High.	Wide.	Deep.				
401	18½	13½	11½	14	11	9½	13½ by 11½	1	28/6	—
402	24½	15½	15	18	11	11	15½ ,, 15	2	40/-	2/6
403	30	18	17	19	11	11	18 ,, 17	2	45/-	2/6
404	30	18	17	19	13½	11	18 ,, 17	2	50/-	2/6
404	If fitted with Enamelled-Lined and Jacketted Door and Fire-Brick Crown, as adopted by The London Gaslight and Coke Co.								55/-	2/6

Any of these Cookers, except No. 401, can be fitted with Griller at an extra charge of 2/6; but the adoption of the Griller is not recommended for use with Prepayment Meters.

JOHN WRIGHT & CO., LIMITED,

The Oldest and Largest Gas-Stove Manufacturers in the World,

ESSEX WORKS, BIRMINGHAM, and 105, CHEAPSIDE, LONDON.

to be taken for odd cargoes to enable pits to be kept fully employed. Thus the average price may be said to have been 8s. 3d. to 8s. 4½d. per ton, free on board; while steam smalls are quoted at 3s. 3d. to 3s. 4½d. per ton. Manufacturing coals show little or no alteration. The deliveries are mainly on old contracts; and thus the prices do not transpire. Gas coals are steadier, and the demand now increases regularly. The gas coal collieries are working better than they have been; and each week should for four months enlarge the requirements of the users. The London companies seem to be taking advantage of the low sea-freights that are still current, and are stocking coal freely. One contract for a Teesside town is being arranged for the gas coal supply. It is believed that it will show no alteration of moment in the prices; while the supply will probably still be drawn from the collieries in the middle and south of Durham. Generally the price of good gas coals varies from about 6s. 6d. to 7s. per ton, free on board, though contracts at much lower prices are known to be running.

Scotch Coal Trade.—A good demand continues for all classes, and supplies are getting more plentiful as the holiday season is expiring. The miners are working steadily; and everything points to better trade being done. It is announced that the leading coal masters in the West of Scotland have intimated their intention to raise the price of splint coal 3d. per ton after Sept. 1. Better prices are already being obtained, the quotations being: Main, 6s. 3d. to 6s. 6d. per ton, f.o.b., Glasgow; ell, 6s. 9d. to 7s. 3d.; splint, 6s. 9d.; and steam, 7s. 6d. to 7s. 9d. A great deal depends, in the matter of improvement or the reverse, upon the attitude of the miners. As yet they are working quietly, and are producing coal in large quantities; but a movement for an advance of wages by from 6d. to 1s. per day has been begun in all the districts, which may prove troublesome. So far the indication is that, should a demand for an increase be pressed, it will be resisted on the ground that for some time many pits have been worked at a loss, and now require a period of better prices to make up. The shipments for the week amounted to 188,769 tons a—decrease compared with the quantity in the preceding week of 7718 tons, but an increase compared with the quantity in the corresponding week of last year of 6798 tons. For the year to date the total shipments have amounted to 4,866,300 tons—an increase compared with the quantity in the corresponding period of last year of 237,346 tons.

Regenerator Settings for the Etwall Gas-Works.—The Etwall Gas Company, under advice of Mr. J. F. Bell, Assoc.M.Inst.C.E., of Stafford, have decided to adopt regenerator settings with new retort-bench mountings; and the whole of the work has been placed with Messrs. R. Dempster and Sons, Limited, of Elland.

Atherton Gas and Water Supply.—During the financial year recently ended, the Atherton District Council have made a profit of £977 on the gas-works and £497 on the water-works. It has, therefore, been decided to transfer to the general district fund a sum of £1000 from the gas account, and £500 from the water account.

The Proposed Purchase of the Fylde Water-Works by Local Authorities.—Arrangements are now well in hand for the acquisition of the undertaking of the Fylde Water Company by the Joint Authorities in the Fylde; and next session, a Bill will be promoted for the purchase of the concern. It has been decided that the Joint Committee who will manage the concern shall consist of fifteen members, Blackpool having seven representatives, Fleetwood three, Lytham and St. Anne's two, and Kirkham one. The draft agreement for the purchase of the undertaking has been approved by the General Purposes Committee of the Blackpool Town Council.

Sales of Shares.—Last Wednesday, the following shares were sold by auction at Norwich: 20 fully-paid £5 shares in the Swaffham Water Company, at an average of £9 7s. 6d. each; 50 fully-paid ordinary £10 shares in the Great Yarmouth Water Company, at £13 5s. and £13 each; 37 fully-paid 5½ per cent. first preference shares of £6 each in the Lowestoft Water, Gas, and Market Company, at £6 10s. apiece; 20 fully-paid additional ordinary shares of £10 each in the same Company, £16 10s. and £16 15s. each; 19 fully-paid original £30 shares in the Great Yarmouth Gas Company, at an average of £60 each; and 25 original £7 10s. shares in the same Company, at an average of £15 each. At Westhoughton, last Wednesday, Mr. J. Rothwell offered for sale 16 fully-paid shares of £10 each in the Westhoughton Gas Company. The proposed purchase of the concern by the Local Authority lent interest to the occasion. The whole lot was disposed of at the undermentioned prices: Five "A" shares at £14 11s. each; five similar shares at £14 13s. per share; and six "B" shares at £14 15s. each. These are by far the highest prices ever obtained for this Company's shares.

Bromley Gas Consumers' Company.—The ordinary half-yearly general meeting of this Company was held on the 20th ult., under the presidency of Mr. A. Dickson. The Directors' report, epitomized in the "JOURNAL" for the 18th ult., was presented, and its adoption moved by the Chairman. In doing so, he remarked that, owing to the diminished consumption of gas, the rental was about £411 less than in the first half of last year. This was a matter for great regret, in face of the very unfavourable condition of the market for coke and sulphate of ammonia. On these two articles alone there was a decrease of £750; and in the net result, the Company had a diminished income of £1078 through the low prices which had ruled for residuals. It was, however, gratifying to point to a reduced expenditure of £1440—the chief item being £818 less for coal. Another source of economy was the adoption of mechanical stoking, by which they had saved £730. The net advantage on the business of the half year amounted to £361, which enabled the Directors to recommend the payment of the usual dividends. The scheme for the replacement of the mortgage debt of the Company by debenture stock issued at the 3½ per cent. rate had been matured as far as it could be carried out at present; and by the new arrangement a perpetual advantage of something like £242 per annum would be gained, which he thought was a very successful operation in their finances. The report was adopted.

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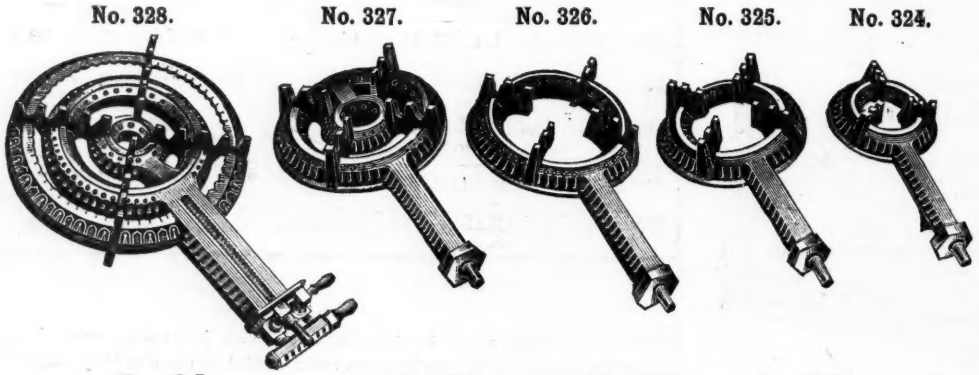
NEW BOILING-BURNERS.



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BROOKE STREET WORKS, HOLBORN, LONDON, E.C.

Late ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON.

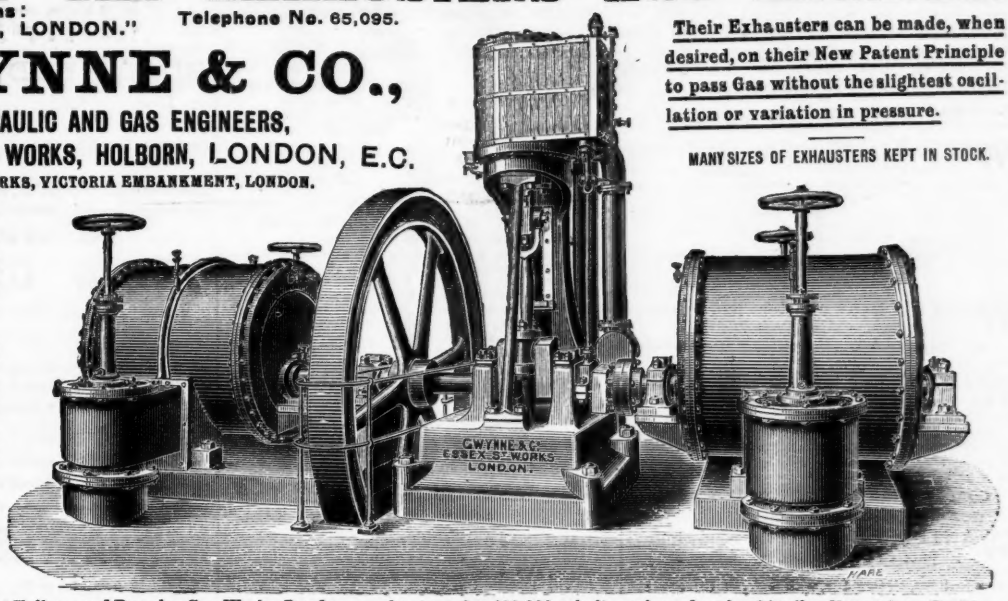
They have completed Exhausters to the extent of 32,000,000 cubic feet passed per hour, which are giving unqualified satisfaction in work.

Makers of GAS-VALVES, HYDRAULIC REGULATORS, VACUUM GOVERNORS, PATENT RETORT-LIDS, STEAM-PUMPS for Tar, Liquor, or Water; CENTRIFUGAL PUMPS and PUMPING ENGINES, specially adapted for Water-Works, raising Sewage, &c.

Also GIRARD and other TURBINES, HIGH SPEED ENGINES, DYNAMOS, &c., &c., for ELECTRIC LIGHTING.

Their Exhausters can be made, when desired, on their New Patent Principle to pass Gas without the slightest oscillation or variation in pressure.

MANY SIZES OF EXHAUSTERS KEPT IN STOCK.



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Catalogues and Testimonials sent on application.

NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of PERMANENT ADVERTISEMENTS, should be received not later than the FIRST POST on SATURDAY.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.

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ANDREW STEPHENSON, AGENT. All communications re Oxide to be addressed to Palmerston Buildings.

WINKELMANN'S "VOLCANIC" CEMENT. Fire Resistance up to 4500° Fahr. in use in most Continental Gas-Works, and in more than 800 British Gas-Works.

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JOSEPH TAYLOR & CO., Chemical Plumbers, &c., and Makers of every description of Solid Plate Lead and Timber Cased Saturators, &c. CENTRAL PLUMBING WORKS, TOWN HALL SQUARE, BOLTON. Special Attention to Repairs.

Before placing Orders, please write for Estimate.

J. & J. BRADDOCK, Globe Meter Works, Oldham.

First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.

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SULPHURIC ACID.

JOHN NICHOLSON & SONS, Limited, Chemical Works, Leeds, specially produce this ACID from SULPHUR, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors for the erection of Gas-Works for Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings, at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.

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THE RELIANCE LUBRICATING OIL COMPANY SUPPLY on APPROVAL "RELIANCE" NON-CORROSIVE LUBRICANTS (which, through their superiority, have the largest sale in the world)—viz., Engine, Cylinder, and Machinery Oils, 11½d.; Spindle Oil, 8½d.; Gas-Engine and Dynamo Oils, 1s. 6d. per gallon; Barrels Free and Carriage Paid. Also Liquids for Gas Making, Enriching, &c.

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FINEST Quality of Natural Bog Ore. Particulars and price, apply to Mr. T. L. ARCHER, 20, Fennel Street, MANCHESTER.

SPENT OXIDE Wanted. J. HARDMAN, Milton, STAFFS.

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JOHN ROMANS & SON, EDINBURGH, Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS and WATER WORKS.

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HYDRATED OXIDE OF IRON.

PREPARED from pure Iron.

Two or three times as rich as Bog Ore.
Strong action on Sulphuretted Hydrogen.
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Can be lent on hire.
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INCREASE the Efficiency of your PURIFIERS by adopting CRIPPS'S PATENT BYE-PASS VALVE in the lower Tiers of Sieves. Practical Experience proves their Economy. Engineers are repeating orders after thorough trial.

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ADVERTISER is desirous of hearing from someone who has a Vol. I. of "KING'S TREATISE ON COAL GAS" to dispose of.
Particulars as to price to S. S., 348, High Street, ROCHESTER.

A WELL-KNOWN Firm of Inland Gas Coal Factors, with London Office, desires to REPRESENT a DURHAM or NEWCASTLE COLLIERY. Highest References.
Address No. 2702, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Situation as Outdoor SUPERINTENDENT. Fifteen years' practical Experience. Five years in present Situation as Manager and Collector. Has a thorough knowledge of Wet and Dry Meters, Main and Service laying, Internal Fitting, fixing Stoves, &c. A First-class Workman. Excellent References.
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WANTED, Retort Setters and Furnace BUILDERS.
Apply to JONAS DRAKE AND SON, Ovenden, HALIFAX.

WANTED, by a large Gas Engineering Construction Firm in the Midlands, a good DRAUGHTSMAN, well up in modern Gas Plant.
Address, in own Handwriting, giving full Particulars, Age, and Salary required, No. 2703, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

CORPORATION OF STOKE-UPON-TRENT.
(GAS DEPARTMENT.)

WANTED, a Clerk with good knowledge of Gas-Works routine. Salary 30s. per week.
Applications, stating Age, with *copies* of three recent Testimonials (which will not be returned), to be sent to F. Geen, Esq., the Chairman of the Gas Committee, Stoke-upon-Trent, not later than Saturday, Sept. 5.
Canvassing will be considered a disqualification.

THE Woking Water and Gas Company require the services of an experienced PRACTICAL MAN, thoroughly acquainted with Main laying, Plumber's Work, and the laying on and inspection of House Service-Pipes, Water-Meters, and Apparatus for Waste Prevention under the Constant-Supply System.
Written applications, accompanied by Testimonials, stating Age, Experience, and Salary required, to be sent to the undersigned not later than the 8th of September next.
B. D. HOLROYD,
Secretary.
5 & 6, Great Winchester Street, E.C.

MILTON-NEXT-SITTINGBOURNE URBAN DISTRICT COUNCIL.

GAS MANAGER WANTED.

THE above-named Council require immediately a WORKING MANAGER for their Gas-Works. Applicants must have a thorough knowledge of Carbonizing and Distribution, and the usual routine of a small Gas-Works.
Salary £2 per week.
Applications, stating Age, and enclosing three *copies* of Testimonials of recent date as to character and fitness, should be sent or delivered to me at my Office, Town Hall, Milton, on or before Monday, Sept. 7 next.
WM. PARHAM,
Clerk to the Council.
Milton, Aug. 26, 1896.

FOR SALE—A Second-Hand Ammonia STILL—viz., 2 feet Still and Heater, and Steam Reducing-Valve. A Bargain. Davis's Patent.
Apply to WILLIAM DREWRY, Gas-Works, GREAT GRIMSBY.

FOR SALE, for immediate delivery—
Four 8-ft. square PURIFIERS, complete with Connections and Centre-Valve, 8-in. diameter.
One 100,000 cubic feet per day LIVESEY WASHER, with Connections.
Four Sets of MOUNTINGS for Six 15-in. Round Retorts, including Hydraulic Mains.
One 4000 cubic feet per hour STATION METER, with new Drum.
Two small SCRUBBERS, suitable for Tanks.
Two 8-in. FOUR-WAY BYE-PASS VALVES.
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SULPHURIC ACID.

THE Gas and Electric Lighting Committee of the above Corporation are prepared to receive TENDERS for the supply of SULPHURIC ACID, made either from Native Sicilian Brimstone, or Recovered Sulphur, or Pyrites.
Specific gravity in each case to be stated. The price to include free delivery by rail into elevated Tanks, 27 feet high, at the Chemical Works, Aylestone Road.
Probable quantity about 1600 Tons, to be delivered as required during the ensuing Twelve months.
Tenders, addressed to Alderman Lennard, Chairman, and endorsed "Tender for Acid," to be delivered at these Offices, not later than Eleven o'clock a.m., on Saturday, Sept. 12.
The Committee do not bind themselves to accept the lowest or any tender.
ALFRED COLSON, M.Inst.C.E.,
Engineer and Manager.
Offices: Millstone Lane,
Leicester, Aug. 20, 1896.

TENDERS FOR COAL.

THE Eccleshill and Bolton Gas Company invite TENDERS for 1000 Tons of GAS COAL, to be delivered at the Railway Station (G.N.R.) in Twelve Months, in such quantities, from time to time, as may be required.
Endorsed tenders must reach me not later than Monday morning, the 7th of September.
J. MELLOR,
Secretary.
Eccleshill, near Bradford.

CITY OF LEEDS.
(GAS DEPARTMENT.)

THE Gas Committee of the Leeds City Council are prepared to receive TENDERS for the erection complete of Four Benches of INCLINED RETORTS at the Meadow Lane Gas-Works, also for the STRUCTURAL IRONWORK for the same.
Plans can be seen, and Specification and Bill of Quantities obtained on application to the undersigned.
Tenders, endorsed "Tender for Inclined Retorts," and addressed to the Chairman of the Gas Committee, Municipal Buildings, Leeds, will be received not later than Tuesday, the 8th of September.
The Committee do not bind themselves to accept the lowest or any tender.
R. H. TOWNSLEY,
General Superintendent.
Municipal Offices, Calverley Street,
Leeds, Aug. 18, 1896.

SOUTHBOROUGH URBAN DISTRICT COUNCIL.

NEW GAS-WORKS.

THE Urban District Council invite TENDERS for the construction of a TELESCOPIC GASHOLDER to contain about 75,000 cubic feet, at the New Gas-Works, Southborough.
Drawings may be seen, and copies of Specification obtained, at the Office of the Engineer, Mr. Corbet Woodall, Palace Chambers, Bridge Street, Westminster, S.W., or at the Urban District Council Offices, Southborough.
One guinea will be charged for copies of Specification, which will be returned upon receipt of a *bond-fide* tender.
Tenders, marked "Tender for Gasholder," and addressed to the undersigned, are to be delivered at the Council Offices, Southborough, not later than Ten a.m., on Wednesday, the 16th day of September, 1896.
The lowest or any tender will not necessarily be accepted.
By order of the Urban District Council,
PHILIP HANMER,
Clerk.
Council Offices, Southborough,
Aug. 20, 1896.

ISSUE OF STOCKS AND SHARES BY AUCTION UNDER PARLIAMENTARY POWERS.

MR. ALFRED RICHARDS undertakes the issuing by Auction of GAS AND WATER SHARES under Parliamentary Powers.
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Terms for the issuing of Capital, and also for offering to auction Gas and Water Shares, and all Particulars relating thereto, may be had of Mr. Alfred Richards.
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This work contains chapters on: The Relative Cost of Light from Gas, Oil, and Candles; Products of Combustion; The Sulphur Question; The Composition of Illuminating Gas; Water Gas; Various Gas-Making Processes; Oil Gas; Properties of Fluid Hydrocarbons; Tar for Gas-Making; Destructive Distillation; Condensation; and Purification.

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Gas Companies are solicited to try Samples of the
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Prices and Analysis on application.
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OXIDE OF IRON.
JAMES HUNTER, MINER, AND SHIPPER OF NATURAL IRISH BOG ORE.
This Estate yields the finest and most uniform quality in Ireland; and the quality is guaranteed,
Samples and Prices on application.
5, PRINCES STREET, PORT GLASGOW.
Telegrams: "HUNTER, PORT GLASGOW."
Established 1872.

NEWBATTLE CANNEL.
Highest Results in Gas, & Excellent Coke.
QUOTATIONS ON APPLICATION TO
THE LOTHIAN COAL COMPANY,
LIMITED,
NEWBATTLE COLLIERIES,
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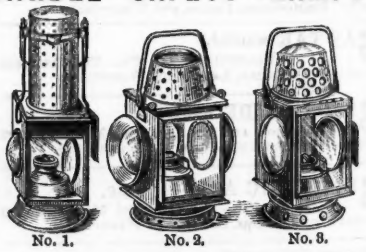
JAMES OAKES & Co.,
ALFRETON IRON-WORKS, DERBYSHIRE,
AND
Wenlock Iron Wharf, 21 & 22, Wharf Road,
CITY ROAD, LONDON, N.,
Manufacture and keep in Stock at their Works (also large stock in London)
PIPES and CONNECTIONS, 1¼ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.
NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts and covers, and rendering leakage impossible.

ARMSTRONG'S PATENT
CANDLE SAFETY LAMPS.

No. 1. No. 2. No. 3.
48, MANCHESTER STREET, GRAY'S INN ROAD, W.C.

THE DRUM
FOR PUMPING AIR, WATER, SEMI-FLUIDS, &c.
See Advertisement in last and next issue.

THE INCANDESCENT GAS-LIGHT COMPANY, LIMITED,

— *v* —

"DE MARE" COMPANY.

THE INCANDESCENT GAS-LIGHT COMPANY, LIMITED.

— *v.* —

"SUNLIGHT" COMPANY.

THE INCANDESCENT GAS-LIGHT COMPANY, LIMITED, HEREBY GIVE NOTICE, as follows:—

VALIDITY. The Company's Patent has been declared VALID ON ALL POINTS after a Fifteen-Day Trial.

NATURE OF INVENTION. The Invention was described by Mr. Justice Wills as a "PIONEER INVENTION."

SCOPE OF PATENT. The Patent HAS BEEN GIVEN A WIDE CONSTRUCTION; and it was held that the protection given by it was not confined to Mantles manufactured according to the particular prescriptions set out in the Specification.

SHAPE OF MANTLE. The Judge held that a Mantle, even if made in a different form or shape (such as the "De Mare" Fringe or Plume), IS STILL AN INFRINGEMENT of the "Welsbach" Patent.

"DE MARE" JUDGMENT. Judgment for an INJUNCTION, WITH FULL COSTS, has been given against the "De Mare" Incandescent Gas-Light System.

"SUNLIGHT" JUDGMENT. Judgment was given AGAINST the "Sunlight" Incandescent Gas-Lamp Company, Limited, on the question of the VALIDITY OF THE PLAINTIFFS' PATENT.

"SUNLIGHT" MANTLES. Last about 100 hours.

"WELSBACH" MANTLES. Last about 1000 hours.

"Sunlight" Mantles BURN DOUBLE THE GAS to produce the same candle power as the Incandescent Gas-Light Company's Mantles.

Users of "Sunlight" Mantles are applying to the Incandescent Gas-Light Company to REPLACE THEM BY THEIR OWN MANTLES.

WARNING. Users of the Incandescent Gas-Light Company's Mantles upon "Sunlight" Burners ARE INFRINGERS OF THE COMPANY'S PATENT, AND WILL BE AT ONCE PROCEEDED AGAINST.

COSTS. Certificates of the Validity of the Company's Patent have been granted both by Mr. Justice Romer and Mr. Justice Wills entitling the Company to Solicitor and Client Costs, which will, IN ALL CASES, BE RIGOROUSLY ENFORCED.

INFRINGERS. The Incandescent Gas-Light Company WILL TAKE PROCEEDINGS AGAINST ALL PERSONS INFRINGING THEIR PATENT WHETHER

MAKERS,
WHOLESALE DEALERS,
RETAILERS,
or
USERS.

Users of the Company's Mantles upon Burners not sold by the Company ARE INFRINGERS.

"LIMITED LICENSE" WARNING. Judgments have already been obtained against such users from Mr. Justice Chitty, Mr. Justice Stirling, Mr. Justice Kekewich, and Mr. Justice North.

FAITHFULL & OWEN,
11, Victoria Street,
Westminster.

Solicitors to the Incandescent Gas-Light Company, Limited.

April, 1896.

NOTICE.

The attention of the METEOR INCANDESCENT LIGHTING COMPANY, LIMITED, having been again called to the Advertisements inserted in various papers by the Incandescent Gas-Light Company, Limited, of Palmer Street, Westminster, to the effect that the "Meteor" Incandescent Gas-Lights are an Infringement of their Patents, and that they will bring Actions for Infringement against all persons found dealing in any manner with such Lights, the METEOR INCANDESCENT LIGHTING COMPANY, LIMITED, HEREBY GIVE NOTICE that they are advised that the "Meteor" Incandescent Lights in no way infringe any of the Patents of the Incandescent Gas-Light Company, Limited, that an action has been commenced to restrain such threats, and that they are PREPARED TO FULLY INDEMNIFY ALL PURCHASERS, DEALERS, AGENTS and USERS of their Lights against any Legal Proceedings on the part of the Incandescent Gas-Light Company, Limited.

WILSON, BRISTOWS, & CARPMAEL,
1, Copthall Buildings, London, E.C.,
Solicitors to the Meteor Incandescent Lighting Company, Limited, of 35, New Broad Street, London, E.C.

Nov. 30, 1895.

PRICE'S COKE & COAL BARROW

effecting a great saving of time, labour, and expense.

For Particulars, Price, &c., apply to Mr. EDWARD PRICE, 119, Queen's Road, FINSBURY PARK, N.

Prices are Reduced.

HOLMSIDE GAS COALS.

PRESENT DAILY PRODUCE OVER 4000 TONS.

LATEST ANALYSIS—By CHARLES PHILLIPS, Gas Examiner to Rotherham Corporation.

Yield of Gas Per Ton. . 11,205 Cubic Feet.
Illuminating Power, 16 $\frac{7}{10}$ Stand. Sperm. Candl.
Coke (of good & pure quality) 13$\frac{3}{4}$ Cwt. Per Ton.
Sulphur . . . . A little over 1 Per Cent.
Ash . . . . . Under 1 Per Cent.
Tar . . . . . 163 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor 103 Lbs. (Avoir.) Per Ton.

HOLMSIDE GAS COALS are supplied to the largest Gas Companies in England and on the European Continent; London alone consuming about half the produce.

SOUTH MOOR PELTON GAS COALS.

PRESENT DAILY PRODUCE AVAILABLE 2500 TONS.

RESULTS OF DIFFERENT ANALYSES:—

Yield of Gas Per Ton. . 10,500 Cubic Feet.
Illuminating Power . 17 Stand. Sperm Candl.
Coke (of excellent quality) . 13$\frac{1}{2}$ Cwt. Per Ton.
Sulphur . . . . . 1·13 Per Cent.
Ash. . . . . 1·34 Per Cent.
Tar. . . . . 180 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor 94$\frac{1}{2}$ Lbs. (Avoir.) Per Ton.

The HOLMSIDE and SOUTH MOOR COALFIELD possesses *a very great quantity of the best Coal;* and, whilst other Coal-Fields are becoming exhausted, this one is only being opened out, so that *the quality* of both the HOLMSIDE COALS, and the SOUTH MOOR COALS *may be relied upon for all practical purposes.*

These Coals may be bought through the Principal Merchants in England, or direct from

MR. MARK ARCHER,
HOLMSIDE AND SOUTH MOOR OFFICES,
NEWCASTLE-UPON-TYNE.

THORNLEY GAS COALS

WORKED BY THE

WEARDALE IRON & COAL Co., LD.

OUT OF THEIR

THORNLEY AND WHEATLEY HILL COLLIERIES.

Analysis made by

Messrs. J. & H. S. PATTINSON, *May 28, 1895.*

Yield of Gas per Ton . . 10,500 Cub. Ft.
Illuminating Power . . 16·9 Candles.
Coke (of good quality) . . 67·5 per Cent.
Sulphur . . . . . 0·58 „
Ash . . . . . 2·73 „

For Price, &c., apply to the

WEARDALE IRON & COAL Co., LD.

QUAYSIDE, NEWCASTLE-ON-TYNE.

THOMAS TURTON AND SONS, LIMITED,

SHEAF WORKS, SHEFFIELD,

MANUFACTURERS OF

FILES OF BEST QUALITY
FOR ENGINEERS.

STEEL OF ALL DESCRIPTIONS.

SCREW STOCKS, TAPS AND DIES,
SPANNERS, RATCHET BRACES, LIFTING JACKS,
ANVILS, VICES,
AND ENGINEERS' TOOLS GENERALLY.

LONDON OFFICE:
90, CANNON STREET, E.C.

TROTTER, HAINES, & CORBETT,

Brettell's Estate

FIRE-CLAY & BRICK WORKS,

STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.

Proprietors of

BEST GLASSHOUSE POT & CRUCIBLE CLAY.

SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

LONDON OFFICE: R. CULL, 34, OLD BROAD ST., E.C.

HEBBURN MAIN GAS COALS.

Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·4 candles.
Coke . . . . . 68 per cent.

For Prices, f.o.b. Ship or Delivered by Rail, apply to

THE WALLSEND & HEBBURN COAL COMPANY, LTD.

8 Lombard Street,

NEWCASTLE-ON-TYNE.

W. RICHARDSON, Fitter.

LONDONDERRY GAS COALS

FROM THE

MARQUIS OF LONDONDERRY'S COLLIERIES,

COUNTY OF DURHAM.

Available output up to 5000 tons per day.
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by Mr. John Pattinson, F.C.S., F.I.S.

FOR PRICES AND PARTICULARS, APPLY TO

S. J. DITCHFIELD,

SEAHAM HARBOUR, COUNTY OF DURHAM.

ROBERT MARSHALL,

CANNEL COAL MERCHANT,

97, WELLINGTON STREET, GLASGOW.

Prices and Analysis of all the Scotch Cannels on Application.

BOLDON GAS COALS.

Worked by THE HARTON COAL CO., LTD.

Output about 3000 tons per day.

ANALYSIS—

Yield of Gas per ton .	10,500	Cubic Feet.
Illuminating Power .	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

Boldon Gas Coals are supplied under contract to

The Gaslight and Coke Company, South Metropolitan Gas Company, Commercial Gas Company, Imperial Continental Gas Association, European Gas Company, L'Union des Gaz (the Continental Union Gas Company), Crystal Palace District Gas Company, Danish Gas Company, Bombay Gas Company, San Paulo Gas Company, Alliance and Dublin Consumers' Gas Company, Ipswich Gaslight Company, Newcastle Gas Company, Sunderland Gas Company, South Shields Gas Company, and to many other Companies at Home and Abroad.

For Prices, &c., apply to the

HARTON COAL COMPANY,

LIMITED,

Newcastle-on-Tyne.

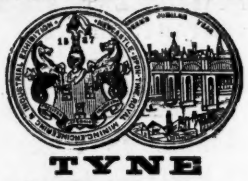
W. H. PARKINSON,

FITTER.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887,

for

CANNEL & COAL.



TYNE

BOGHEAD CANNEL.

Yield of Gas per ton . . . . . 13,155 cub. ft.
Illuminating Power . . . . . 38·22 candles.
Coke per ton . . . . . 1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 17·8 candles.
Coke . . . . . 70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·3 candles.
Coke . . . . . 73·1 per cent.

For Prices and complete Analysis, apply to

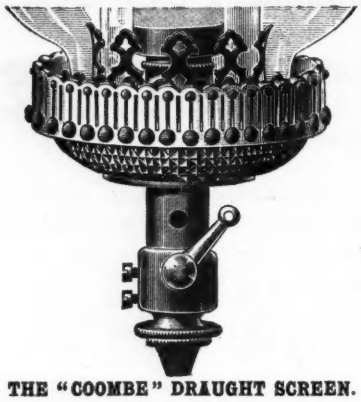
THOS. W. DANCE & SONS,

COAL OWNERS, NEWCASTLE-ON-TYNE;

OR

E. FOSTER & CO.,

12, JOHN STREET, ADELPHI, LONDON, W.C.



THE "COOMBE" DRAUGHT SCREEN.
Protection granted, 1896, No. 2075.

THE "COOMBE" DRAUGHT SCREEN FOR INCANDESCENT BURNERS.

ADVANTAGES.

1.—Prevents draughts of cold air from ascending the Chimney, and thereby lengthens the life of Chimney and Mantle.
2.—Prevents attempts to light spills, &c., in Bars and Restaurants, by which many Mantles are destroyed.
3.—Presents an ornamental appearance, which greatly adds to the beauty of the Burner.
4.—Prevents "Lighting-Back," and keeps out dust and dirt.

SOLD EVERYWHERE.

Wholesale of the Patentees,

ALFRED ARCULUS & CO., GLASS MANUFACTURERS, BIRMINGHAM.

"An Incandescent Burner without a Draught Screen is like a Man without a Collar."

THE "SIMPLEX" CARBURETTER

W. E. PRICE'S PATENT.

A NEW AND PERFECT METHOD OF ENRICHING GAS IN LARGE OR SMALL QUANTITIES AT A MOMENT'S NOTICE.

Special Features of the "SIMPLEX"—

SIMPLICITY, PERMANENCE OF RESULTS, CHEAPNESS, AND ENTIRE ABSENCE OF CONDENSATION.

For Prices and further Particulars, apply to the Manufacturers,

GIBBONS Bros., Ltd., DUDLEY.

ALEX. C. HUMPHREYS, M.Inst.C.E. A. G. GLASGOW, M.E.

MESSRS. HUMPHREYS & GLASGOW

Have constructed their EUROPEAN type of

CARBURETTED WATER-GAS PLANT

At the following Gas-Works:—

Copenhagen	700,000 Cub. Ft.	Brighton	1,500,000 Cub. Ft.
Belfast	1,700,000 ,,	Preston	1,500,000 ,,
Glasgow	300,000 ,,	Southport	750,000 ,,
Brussels	700,000 ,,	Bath	1,000,000 ,,
Liverpool	3,500,000 ,,	New York	1,200,000 ,,
Tottenham	750,000 ,,	Newburgh, N.Y.	350,000 ,,
Santiago	400,000 ,,	Tottenham (Second Contract)	750,000 ,,
Swansea	750,000 ,,	St. Joseph, Mo.	750,000 ,,

And have now under Contract:—

Belfast (Second Contract)	4,500,000 Cub. Ft.	Edinburgh	2,000,000 Cub. Ft.
Shanghai	225,000 ,,	Stockton-on-Tees	500,000 ,,
Winchester	200,000 ,,	Stockport	500,000 ,,
Hoylake	125,000 ,,	Norwich	1,000,000 ,,
Manchester	3,000,000 ,,	Guildford	350,000 ,,
Brussels (Second Contract)	700,000 ,,	Syracuse, N.Y.	850,000 ,,
Holyoke, Mass.	600,000 ,,	Bordentown, N.J.	125,000 ,,

In addition to which the previous Installations of The Gaslight and Coke Company under this System have a total capacity of 10,000,000 cubic feet per diem.

9, Victoria Street, London, S.W.

Telegrams: "EPISTOLARY, LONDON."

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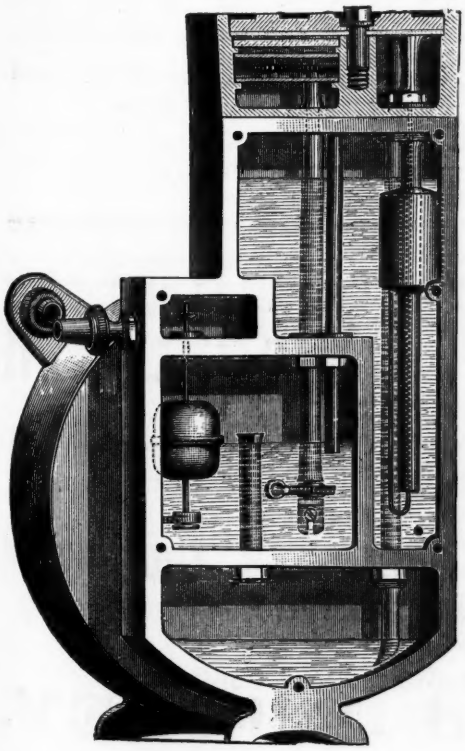
ALDER AND MACKAY,

MANUFACTURERS OF

IMPROVED WET AND DRY GAS-METERS

IN CAST-IRON AND TIN CASES OF THE HIGHEST EXCELLENCE.



Sole Makers of Green's Patent Underground Wet Gas-Meters for Street Lighting, &c., and Ogden's Patent Spindle Tube for Wet Gas-Meters.

GREEN'S PATENT UNDERGROUND METER

Has been designed to obviate that which has hitherto prevented the general adoption of underground Meters—namely, their serious cost. No box is required; and the saving thus effected as compared with ordinary underground Meters, where either a box or meter-pillar is necessary, is fully one-half. The price of one for three lights is 28s.; and the other sizes are correspondingly cheap. When fixed, the only part of the Meter exposed to view measures 6½ inches by 3½ inches. By the Indicator with which the Meter is fitted, the Inspector can at once discern whether water is required; but as the Meter is of the compensating description, water will probably need only be supplied ONCE A YEAR. It is advisable to fill the Meter with a non-freezing liquid, which does not injure the fittings; and this can be supplied at about 1s. 3d. per gallon.

Prices and all Information on Application.

NEW GRANGE WORKS, EDINBURGH.

HIGHEST AWARDS given for our WET and DRY METERS at

Exhibitions held at GLASGOW, CALCUTTA, and EDINBURGH.

Wrought-Iron

And Fittings and Accessories.

LAMBERT BROS., WALSALL,

MANUFACTURERS OF
WROUGHT-IRON TUBES & FITTINGS for GAS, WATER, & STEAM,
BRASS GAS-FITTINGS, GAS-VALVES, STEAM & WATER VALVES, TOOLS, &c., AND OF
WARNER'S PATENT MARKET GAS STAND-PIPE.
LONDON: LAMBETH BRASS & IRON CO., Short Street, LAMBETH.

HUTCHINSON BROTHERS,

GAS ENGINEERS, &c.,

MANUFACTURERS OF

Improved Wet & Dry Gas-Meters.

STATION-METERS. LAMP-METERS.

Test Gasholders and General Gas Apparatus.

Brass Main & Lamp Taps. Unions, Ferrules, &c.

The "Falcon" Lamplighter's Torch. Service Cleansers.
SYPHON AND OTHER PUMPS.
WOOD AND WROUGHT-IRON PURIFIER-GRIDS. SCRUBBER BOARDS.
WET AND DRY METERS REPAIRED.

FALCON WORKS, BARNSLEY.

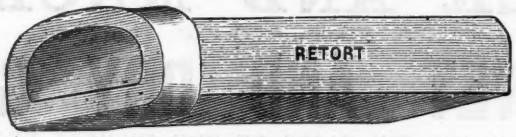
Telegrams: "HUTCHINSON BROS., BARNSLEY."

PHILADELPHIA EXHIBITION, 1876.

ALSO SILVER MEDAL, PARIS.

The Highest Award for Gas-Retorts and other Goods in Fire-Clay has been awarded to KING BROTHERS for their Goods made from their renowned Stourbridge Fire-Clay.

KING BROTHERS,



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STOURBRIDGE CLAYS,

Manufacturers of

Fire-Bricks, Tank Blocks, Glass-House Bricks and Pots, Gas-Retorts, Crucibles in Clay and Plumbago, Gas-Oven Bricks, Bricks for Regenerator Furnaces and Hot-Air Stoves.

STOURBRIDGE, ENGLAND.

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N.B.—Gas, Blast-Furnace, and Glass-House Bricks and Glass-House Pots always in Stock, or made on the Shortest Notice.

MOBBERLEY & PERRY

STOURBRIDGE.

Manufacture & supply best quality of

Gas Retorts (SEGMENTAL, HORIZONTAL, or INCLINED.)

Special Bricks & Blocks for GENERATOR & REGENERATOR FURNACES.

FIRE BRICKS, LUMPS, & TILES, BLUE STAFFORDSHIRE VITRIFIED BRICKS FOR PAVING, &c., &c.

EVERY REQUISITE FOR GAS-WORKS. Retort Setters sent to any part of the Kingdom.

Contractors for the erection of Retort-Benches complete.

London Agents:

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ARROL-FOULIS

PATENT AUTOMATIC MACHINERY

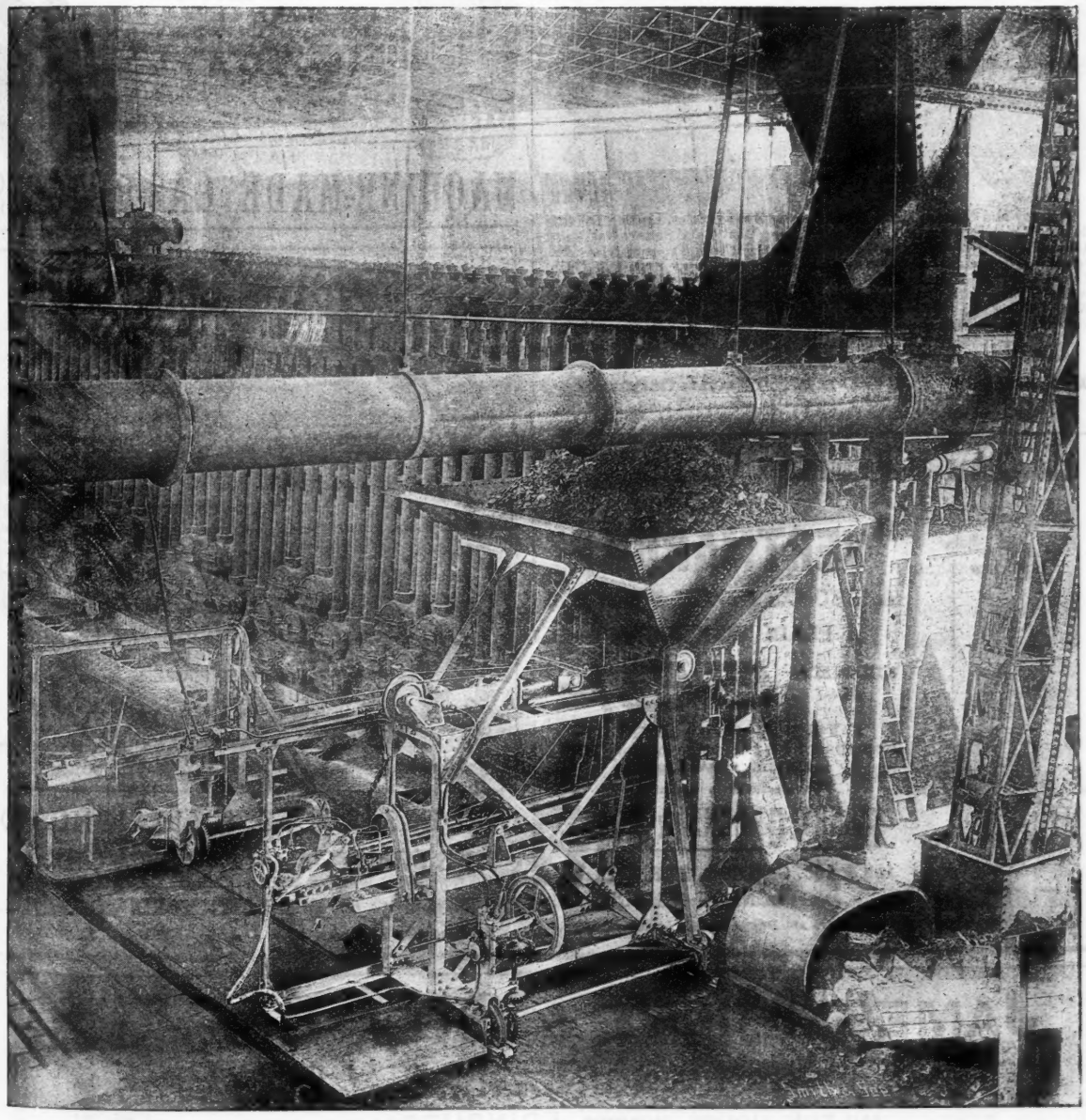
FOR

CHARGING AND DRAWING GAS-RETORTS

SIR WILLIAM ARROL & CO., Ltd., Sole Makers,

GLASGOW.

Plans and Estimates furnished on application.



The above engraving shows the interior of a Retort-House at the Tradeston Gas-Works, Glasgow, where the Machines have been at work since the beginning of 1893, drawing and charging **960 Retorts every 24 hours. 102 Drawing-Machines and 70 Charging-Machines are at work, or in course of construction.**

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OF GASELIERS
IN GLASS AND METAL.

WILSON CARTER & PEARSON,

GAS COAL AND CANNEL FACTORS,

Supply to any Railway Station, or for Export, all kinds of Fuel for Gas purposes.

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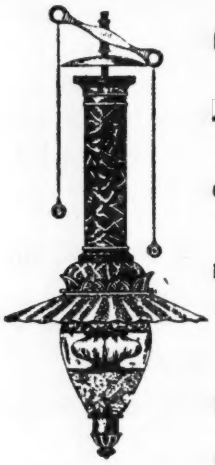
Gas-Bags for Mains. High Water-Boots. Woollen Miners' Jackets.

Delivery and Suction Hose, Gutta-Percha Acid Bottles, Leather Driving Bands, Woven Canvas Hose for Fire-Engines, Wedge and Square Gas-Bags, Air and Water Beds for Invalids, Oil Tarpauling Coats, Trousers, Hats, &c., Squeegees for cleansing Pavements, &c., Billiard and Bagatelle Cush, Tricycle Tyres, Leather Hose, Cotton Waste, Engine Cloths, Oils, &c., India-rubber Waterproof Garments for Walking, Driving, or Sporting Wear, Diving and Wading Dresses, Printers' Blankets, Iron Wheels and Rollers covered with India-rubber. Stokers' Gloves, 14s. 6d. per dozen.

Write for Price List to

THOMAS BUGDEN, Manufacturer,
71, GOSWELL ROAD, LONDON, E.C.

The Climax of Regenerative Gas Lighting!!



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"VERTMARCHE"
A 280-CANDLE POWER
PLAIN IRON LAMP,
CLASS A— 55/-
LIGHT for LIGHT
less than half the price of any other Regenerative Lamp.
Manufactured in England.

HENRY GREENE & SONS,
153 & 155, CANNON STREET, LONDON BRIDGE, E.C.
PARTICULARS AND PRICES FREE. AGENTS WANTED.

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STOURBRIDGE.

MANUFACTURERS OF
BEST FIRE-BRICKS; INCLINED, HORIZONTAL, and SECTIONAL RETORTS; LUMPS, TILES, &c., of every description.
Established 1860.

OXIDE OF IRON.
NATURAL BOG ORE FROM OWN MINES.
Samples and Prices on application.

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Incorporated with the Leeds Fire-Clay Company, Ltd.,
WORTLEY FIRE-CLAY WORKS,
Near LEEDS,

Have confidence in drawing the special attention of GAS ENGINEERS to the following advantages of their Retorts:—
1. Smooth interior, preventing adhesion of Carbon.
2. They can be made in one piece up to 10 feet long.
3. Uniformity in thickness, ensuring equal Expansion and Contraction.

PATENT
MACHINE-MADE GAS-RETORTS.

MAKERS OF
CLAYTON, SON & Co LTD LEEDS.
ALL KINDS GAS PLANT
12,100,000 CUB FT CAPACITY.
COMPLETED IN 12 MONTHS
GASHOLDERS
SPECIALITY
IT IS 300 FT DIAR. HAS SIX LIFTS, EACH 30 FT DEEP. HAS NO ROPES OR SPIRAL GUIDES.
MAKERS OF THE LARGEST GASHOLDER IN THE WORLD
HIGH CLASS BOILERS &c
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JAMES MILNE & SON, LTD.,
GAS ENGINEERS,
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LONDON. — GLASGOW. — LEEDS.

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IMPROVED

Sulphate of Ammonia Apparatus.

The most successful and approved Apparatus known up to the present time.

FOR REFERENCES, PARTICULARS, TESTIMONIALS, AND PRICES, APPLY TO

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ENGINEERS,

NOTTINGHAM.

The Apparatus has been supplied to the following Firms—

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WM. BUTLER & CO., BRISTOL.
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HALIFAX.
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NORTHWICH.
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MACHINE-MADE RETORTS

Have been made in large quantities for the last twelve years; and during the whole of that time, have been in regular use at most of the largest Gas-Works in the Kingdom. They possess the excellent quality of remaining as near stationary as possible under the varying conditions of their work—a quality which will be appreciated by all Gas Engineers and Managers. The generally expressed opinion is that these Retorts are the very best that are made.

RETORTS CAREFULLY PACKED FOR EXPORT.

Fire-Bricks, Lumps, Tiles, &c., &c., of every description suitable for Gas-Works.

THE PEEBLES PROCESS.

The Oil Gas Enrichment Company's Patents.

This Process for Enriching Coal Gas has now been adopted by nearly **50** Gas-Works at Home and Abroad, and continues to give complete satisfaction.

VERY LARGE PROFITS HAVE ACCRUED AT GAS-WORKS WHERE IT IS IN OPERATION; AND THE TROUBLE ARISING FROM NAPHTHALENE DEPOSITS HAS BEEN REMOVED.

Reference is kindly permitted to the Engineers of the following Gas-Works:

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For further Particulars, apply to the Licensees—

R. & J. DEMPSTER, Ltd.

GAS PLANT WORKS, NEWTON HEATH, MANCHESTER.

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JOHN BROWN & CO., LTD., SHEFFIELD.

Proprietors of

ALDWARKE MAIN, CAR HOUSE & ROTHERHAM MAIN COLLIERIES, NEAR ROTHERHAM.

ALDWARKE MAIN GAS COAL

Analysis: 12,600 Feet of 19-Candle Gas per Ton.

Value in Pounds of Sperm, 820·80.

VERY FREE FROM IMPURITIES.

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SOLE AGENTS For "HISLOP'S" PATENT REGENERATIVE FURNACES. FOR ENGLAND, WALES & ABROAD.

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Wellington, Nelson, and Market Street Works,

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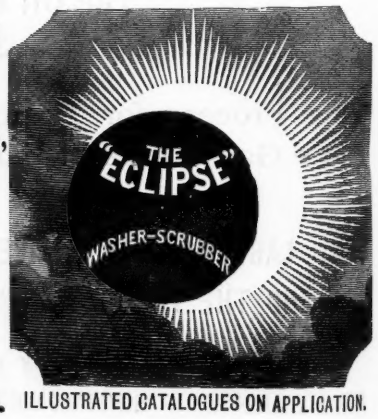

RETORT-FITTINGS, CONDENSERS, PURIFIERS, WITH PLANED JOINTS.

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Manchester Corporation. .	2 Machines	4,000,000 each.
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Do. do. . . .		1,500,000

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